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SECTION I
SCHOOLS FOR TOMORROW

AN ANALYSIS OF PLANNING FOR POST-WAR SCHOOL CONSTRUCTION

By N. L. ENGELHARDT

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THE present war has brought about greater changes in the thinking of people than perhaps any other conflict in world history. It has necessitated learning intimately about the mores, the habits, the ideas, and the ways of living of all peoples. It has raised issues about future world controls, about the access of nations to raw materials, and about the changes that will take place in world trade.

The forces let loose in the present world war have exceeded in quantity and power those that man has ever before controlled. Destruction has reached unprecedented proportions. The weapons of war have steadily increased in magnitude. In widespread demolition neither church nor library, university nor school, simple cottage nor palace, has been by-passed by the elements of destruction. The enemy has operated to destroy not only man's pattern of government and living, but also the very structures which housed them.

The New Forces Are Gigantic in Nature

The world war represents a struggle between giant forces. Man's inventive genius and his productive powers have been used to magnify those forces. The results have been enormous fortresses, with revolving turrets and powerful cannon lumbering on rubber tires and caterpillar treads wherever man desired to go. In search of the enemy he has driven his fortresses through forests, across rivers, and over mountain slopes and deserts of sand. He has built flying ships of unprecedented tonnage and destructive gun power to bomb cities and fight the battle of the skies. To provide adequate bases for his planes he has in record time constructed floating landing fields of wood and steel, and sailed them over all the seas. His weapons of destruction have been increased in size and striking power to the point where they can instantaneously destroy blocks of a city or acres of industrial plants. New challenges to creativeness for purposes of destruction emerge each day; and man, in his struggle for survival, brooks no delay in meeting them.

Such, briefly, constitutes part of the world picture in 1943. Here is a gigantic struggle for which man has created giant instruments of war. The destruction is world-wide with no mercy for man's cities and the people's future. In this struggle man has put forth every ounce of energy, reaching new heights of achievement. He has fought with equal courage under water, on land and sea, and at incredible heights in the air. He has summoned to serve him all of the inventions of the technological age, and has unleashed the forces of invention to provide greater production for his fighters and assure the destruction of his enemies.

With all its destruction and fury, the war has brought untold advantages to man through new discoveries in all fields of science. Necessity has compelled advancement in medicine, in industrial production, in the creation of substitute materials, in the perfection of instruments for safety and performance, and in the planting and provision of foods.

The War's Contribution to Future Planning

The question that may well be raised is, how will all of these gains realized in wartime activities be successfully turned to the development of a lasting peace? What lessons coming out of the war will affect the kinds of cities man builds, the character of the homes in which he lives, the kind of factories that he constructs, and the kind of school facilities he will desire for the advancement of civilization? Millions of people are thinking about the post-war world and are dreaming their dreams of freedom and future achievement. The world will never again return to its former status. What planning can now be done to prepare for the period of reconstruction?

Previous Lack of Group and National Planning

Many will recall that, at the end of the first World War, problems of all kinds multiplied because of the lack of planning. The schools continued more or less with their traditional programs, as though the violent world convulsions had brought about no need for adjustment. The transfer of young men from military life to civilian pursuits resulted in much disillusionment because the proper directive forces had not been harnessed. The people of the nation lulled themselves into believing that they could go back to "normalcy," and showed the bent of their minds by their presidential votes.

Following the period of inflated prosperity, the nation found itself in the worst depression of all times.

The Joan of Arc Junior High School in New York is often referred to as the city's "first skyscraper school." This type of construction left 31,000 sq. ft. of the site available for playground space. The building was designed for afternoon and evening community use

Heroic efforts were made to stem the tide. New educational organizations, like the NYA and CCC, emerged. The adaptation of traditional institutions and organizations to such programs was neglected, on the assumption that they were not sufficiently flexible to provide the needed adjustment.

The PWA was developed to take up slack in employment. In unbelievably short periods thousands of architects, working under tremendous pressure and without benefit of early planning, created plans for schools, hospitals, libraries, and government buildings. In spite of unfavorable conditions surrounding the developmental and construction program, many fine results were secured. It is fair to say, however, that longer periods of preparation, and the application of thoroughgoing planning procedures, would have produced results far superior to those secured under the difficult conditions that prevailed.

The WPA found its place in American life as an agency for economic and social relief. It has served many admirable purposes and made living happier and more meaningful for millions of workers. Long-time planning, developed on the basis of clearly stated objectives, would probably have put men to more constructive work than raking leaves, aimlessly transferring soil, or doing other futile jobs which led to distaste for such work and brought on bitter criticism and destructive ridicule.

Three decades of experience with convulsive economic changes have sobered the thinking of American people. Without doubt most of them, if questioned, would approve of nation-wide planning that would make for individual adjustment at the end of this war, and that would assure long-time dividends from investments made in the facilities man needs for carrying on the enterprises essential to the transformation of his ideals into realities. "Planning" used to be a word which was frowned upon by the American people. Times and experiences have changed their understanding of its meaning. The people today realize as never before that intelligent far-sighted planning is a "must" task if the interests of all men are to be conserved.

The National Resources Planning Board

To be sure, governmental agencies have for years been participating in some of the broad aspects of planning. The citizen who is unfamiliar with what has been done owes it to himself to review the outstanding documents issued by the National Resources Board and Advisory Committee, its successor, the National Resources Committee, or what is now called the National Resources Planning Board. The titles of their reports give a general idea of the scope and thoroughness with which the problems of a nation are being analyzed. *Farm Tenancy, Recreational Use of Land in the United States, Our Cities, The Future of the Great Plains, Development of Resources and Stabilization of Employment, Federal Aids to Local Planning, Regional Planning, The Status of County Planning, Toward Full Use of Resources,* and *The Structure of the American Economy* are a few of the publications, showing the extent to which competent workers have been delving into the problems of our people.

The September 1942 pamphlet of the National Resources Planning Board, *Post-War Planning,* emphasizes three objectives: (1) full employment, (2) security, and (3) building America. School-board members and school administrators will enhance their services to the public by becoming thoroughly acquainted with the contents of this pamphlet, as well as with any of the others that seem to them to be of primary importance in the regions they serve.

The Fourteen Points

The fourteen points for education included in recommendations of the National Resources Planning Board, as transmitted to the Congress by President Roosevelt in March, 1943, merit the attention of every school board member because of the comprehensive area covered. They are as follows:

1. Equal access to elementary and high school education for all children and youth.
2. At least half of all children between three and five years, inclusive, receiving pre-school education.
3. A six-fold increase in enrolments in junior colleges and technical institutes and lesser expansions in other types of higher and graduate education.
4. Expansion of adult education, including library service.
5. Expansion of education for children who need special types of instruction.
6. A higher quality of education at all levels.
7. Special training and education for demobilized soldiers, sailors, and war workers.
8. Camp facilities for all youth.

9. Healthful school lunches for all children who need them.
10. An extended program of school building construction and repair.
11. Enlargement of school administrative districts so that, except in the most sparsely populated areas, high schools with at least 400 pupils will be provided.
12. More school dormitories and transportation facilities in rural areas.
13. Strong state and federal leadership in education.
14. Adequate funds to carry out the above recommendations.

Proposed Post-War Works Program

The present world struggle had scarcely begun before national and community leaders organized to develop plans for public works, to be lodged in a great reservoir at Washington. The intent has been to be ready at the earliest moment to forestall the results of the great dislocations that will occur in the transfer from wartime to peacetime industries. Large bundles of blueprints have already been rolled up ready for submission for bids. Bridges and fire-houses, prisons and hospitals, city halls and school buildings are among the many types of structures for which plans are now in the making. The early development of this program is most commendable. It represents an essential safeguard against the repetition of unfortunate upheavals following past periods of cyclonic economic transitions.

How Will Your City Change?

Before the draftsman begins a drawing of a school, full consideration should be given to the changing nature of cities and the character of buildings. In the past, cities have been located to meet the military and trade needs of the time. An occasional city has been built to satisfy the whims of an emperor or conqueror, but most urban developments have developed logically from the prevailing transportation, communication, and security conditions of the periods of their origin.

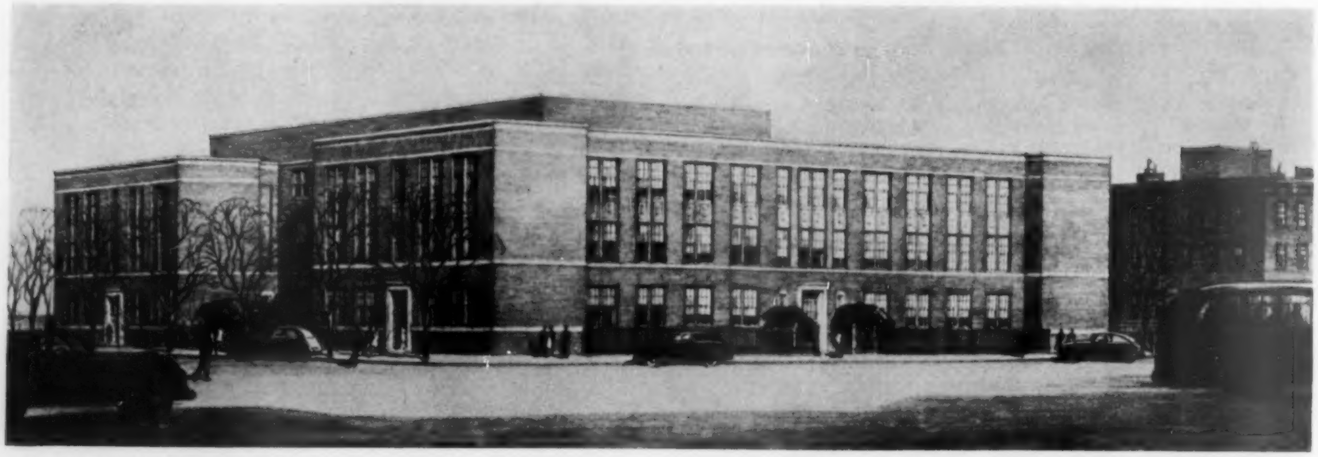
There have been great investments made in cities which, in many cases, served their purposes for a span of years and then crumbled and disappeared. Time and economic changes are no respecters of cities. As trade and industry are influenced by changes in transportation, discovery of new sources of raw materials, or shifts in the labor market, physical facilities are abandoned or slowly succumb to decay. Population figures rise and fall radically as opportunities for employment are altered, immigration policies are changed, or birth rates show upward or downward trends.

How Cities Rise and Fall

Over the years cities have been built where land and water met, thus securing the advantages of rail and ship transportation. The hill towns of Europe attracted man because they were easy to defend. Cities in our midwest grew from trading posts to large centers of population because they were the natural gateways to the opening of western lands. Inland cities prospered when they were fortunate enough to be located near sources of oil or ore. In other words, man has built his cities to excel in defense or to meet expanding needs of trade.

Such cities prosper as long as conditions continue to add to their wealth and satisfy the needs of their

Junior High School 49 in Brooklyn, N. Y., was planned and built as part of the Williamsburg Housing Project. Note the large play area in front of the school. Modern planning requires schools to be included with homes in any comprehensive program



One of the post-war school projects planned for the Harlem section of New York. It will have 40,000 sq. ft. of playground space

population. Changes in the character of ocean trade can cause the rapid decline of seaboard cities. The discontinuance of a trunkline railway can spell disaster to its terminal ports. The transportation of bulk cargoes from sources of supply to remote points of use can leave intermediate cities without adequate trade support. Thus cities have prospered or declined according to new means of transportation or other fundamental changes that advanced the general interests of state or nation.

Destructive War Affects City Planning

Some centuries past the Roman cry was "Carthage must be destroyed!" The city's walls were flattened, its buildings razed, and its population destroyed. In the present war a similar intent seems to prevail. The results have already been felt in hundreds of centers. The rebuilding of some of these centers has already been planned. It will be exceedingly unwise if new patterns of urban development are not evolved and populated centers are not conceived in terms of the lessons learned out of this war. It is hoped that a third world war will never come; but newly massed buildings in congested urban areas ought not to be offered as the targets if another conflict arises. Perhaps the densely populated cities, whose prosperity and growth were stimulated by the trade, communication, and transportation facilities existing in the past century, have reached their all-time peaks. It may be that the urban concept as it developed in Europe and imprinted its pattern throughout the rest of the world will be supplanted by new community designs better adjusted to contend with the forces that have emerged in this technological age.

Gas and Rubber Civilization

The part that gasoline and rubber play in everyday living has been brought home vividly to the American people. Their use has been widely curtailed; but the post-war period will witness an increase in quantities consumed considerably beyond anything used in the past. If raw materials are not available, synthetic products will take their place. American citizens have profited so greatly from the advantages accruing from the extensive use of gas and rubber, that they will never be content without abundant supplies in times of peace. Recreational opportunities have been increased. Freedom from urban congestion has been provided. Time in travel has been reduced; and wider knowledge and better understanding of an ever-expanding environment have been made possible for millions of citizens. Gas and rubber, when used with wheels, have given civilization many advantages. As they are linked increasingly with wings, untold other advantages will appear.

Impact of Automobile and Airplane Upon Cities

As transportation in this country moved from rails to rubber, American cities were vitally affected. Cities, which had grown largely because they were at the meeting point of shipping and rail lines, lost many of the advantages which they alone possessed. Goods and people, instead of following fixed lines of travel, could be moved anywhere with ease. The decentralization of cities, begun with the introduction of the automobile, may be expected to continue at even greater speed with the post-war increase in automobile traveling.

The freedom of travel assured to man through the airplane makes for even greater change in the cities of the future. Already air cargo transports of 100 to 150 tons are said to be in the blueprint, if not the manufacturing, stage. Tonnage far in excess of this has been promised by the aeronautical engineers. The flying fortresses of war have become so large that they will take considerable punishment in air battle before they are downed. Many of them, because of their size, are able to return to their bases even though torn and battered.

As man builds and flies "the beef-boats, ore-flats, petrol-tanks, and grain-tubs" which Kipling in 1909 described in flight in his story "With the Night Mail," it will no longer be necessary to build cities where land and water meet. Our large cities may no longer be on the fringes of the sea. Man may wish to take every advantage of health and climate as he locates the cities of the future. Improvement in vertical landing and taking-off, and the selling of airplanes at a cost equal to that of medium-priced automobiles, coupled with the nation's enthusiasm about our military success with the airplane, promise to usher in widespread use of the airplane for personal as well as business purposes. When our citizens can fly 100 miles or more to business each morning, or can week-end in

a foreign land because of the cheapness and speed of the airplane, it is clear that the effect upon congested cities will be marked.

The War Stresses Certain Educational Needs

The health and physical education program of schools has been extended greatly because of wartime demands. The post-war program of health and physical education will stress open spaces, fresh air, sunlight, and recreational areas not limited to the few but made available to all. The "commando" activities of wartime will be supplanted by opportunities in educational and recreational camps. Again, these opportunities must not be limited to a few, but must be provided for the many; so that each may learn about the out-of-doors and grow strong and vigorous. For these reasons, small sites will not meet the needs of the schools of the future.

In the high schools, part of the instruction of every youth will be lessons in automobile driving, for which driving grounds will be needed. The high schools may be expected to give flying training in low-powered planes—for this alone a minimum of 320 acres is essential. Glider training will be enthusiastically sought after by high-school boys and girls. A permanent gliding camp for groups of schools may be one of the solutions for this need. All this suggests that public schools of the future may have more than one center of activity, each of which will be designed to meet specific needs.

The pre-induction courses necessitated by the war have given a renewed emphasis to vocational education and the relationship of vocational work to the academic work of the schools. Shops built according to prevailing industrial practices, rather than as parts of monumental schoolhouses, will require more land than has been set aside for them in the past. They also must serve for the instruction of adults along vocational lines, and provide for adjustment to new types of work. This means that the shop center in a school must be conceived with due reference to long day and evening use and to the need for expansion as new types of trade and technical learning are required.

The war has stressed essential types of civilian training—namely, mass feeding, mass care in case of injury, mass housing, and mass morale. Even though there may be no third world war, some phases of these worth-while wartime endeavors are transferable to peacetime, especially as aids in time of depression or disaster. Where such education should be given, and what provision should be made for it, are questions that must be raised.

Education and Social Welfare

The war is merging the problems of education and social welfare. It is becoming increasingly difficult to draw the line between the educator and the social welfare worker. The school of the future will be the community school, in which all of the many problems of the community are worked out through both the educational and the ameliorative processes. Younger children will go to school, where their complete needs will be provided for. The community school will make provision for adult education. It will not be a "hit or miss" program, but will be specifically organized to meet the needs of all groups and individuals. Adult education programs require schools that are attractive to adults and which make possible adult learning and participation under democratic conditions. The post-war schools must be different from pre-war schools, in that the requirements of education as a life process must be thought through and put into action. Future school facilities must be constructed to make realities of the ideals which radio and press are hourly setting up as the results to be attained from the sacrifices of this war.

No Postponement of Planning

Today, and not tomorrow, is the time to begin planning for post-war construction. All the factors mentioned above may not be pertinent to the planning of every community—the task of each community is to discover for itself the prospects which lie ahead. This is no easy task. It requires study and analysis, discussions and decisions, community approval, and legal adoption of a program. The authorities of other branches of community administration outside the

The Thomas A. Edison Vocational High School is another of New York's post-war projects. It is designed for community as well as school use and will have 122,000 sq. ft. of playground space

This new Machine and Metal Trades High School in New York City is built like a modern industrial plant

schools should be encouraged to participate with boards of education and educational workers in a comprehensive community analysis.

The role of education in the future program should be fully discussed. Education is playing a far more important part in the present World War than it has in any other war. To the same degree will it play a more important part in the peacetime activities of our people. Hence, it is essential that a program which presents manifold possibilities should be envisaged.

No plan should be adopted which is limited in scope and which ignores the future potentialities of the community. The beginning of the program may be relatively simple; but if it is not a part of a comprehensive whole, including planning for all age groups and for all types of educational needs, then it would be far better not to initiate it at all.

Planning the Population Center

Adding a few more streets to the present city's gridiron, developing a few more parks, and extending public service facilities, will not constitute adequate planning for the population center of the future. There must be created a new design for living and working. The plan of physical facilities to fit this design should be conceived in the light of all of our unfolding knowledge. The educational facilities in such a plan should be proposed only as every phase or step in the thinking is questioned in the light of modern developments. The basic question is, What kind of curriculum is to be offered? Next come questions like these: What space needs do educators require to make possible the meeting of the curriculum objectives? What kind of a plant design satisfies these educational needs? What kinds of new construction material are emerging out of the war, the continued use of which in peacetime will produce economies as well as other advantages? To what degree can the school be developed so that it becomes the center toward which gravitate the interests of the community itself?

Length of Period of Planning

On the declaration of peace there will be haste to get the post-war construction program of the nation into action. Therefore, planning should now proceed with the expectation that the war *may* be concluded in a year's time. After that there may be time left for review and reconsideration. Copies of the plans should be filed with the Public Works Reserve in Washington. With their filing might well go a brief, stating the bases and the reasons for the planning. Here could be included the ideas of community change that have come from group discussions, the constructive thinking that has been done with respect to the design of the future community, and the part assigned to education to carry on the work of the community. This document might well indicate that the war has taught our communities lessons in democracy and that these lessons have fruition in terms of plans in which the common good has been the sole basis for action.

No post-war construction program should be hurried into action at the last moment. There must be a sufficient period for the review of the forces now impinging upon our lives. There should be no redrafting of plans of buildings that have already been erected. The buildings of the future will be different; how *much* different will be the decision of the long-time planning groups.

Authorities Must Have Vision

The public education program of the post-war period will have new life fused into it. The courses and curricula will be modified to meet the insistent demands of youth returning from military service, as well as to conform with the maturing judgments of the civilians who carried on at home. New developments of the technological age will emphasize the needs for wider knowledge in many of the old-time subjects as well as the acquisition of new skills. The educational program will change to conform to the needs of the times, just as it has in this war period. The teacher will adjust himself to the changing demands, and the physical facilities must be designed to fit into the new pattern of community life.

The best results can be secured for this post-war construction only as responsible authorities grasp the vision and, through democratic procedures, lead the way.

SUBURBAN SCHOOL BUILDING AFTER THE WAR

By RHEES E. BURKET

Architect, Washington, D. C.

CHANGE is fundamental. Whether we like it or not, few human institutions can go on year after year in the same manner. Those that do so are soon left like rocks in the dry bed of a river which has cut a new channel.

Architecture in every stage of world history has reflected the life, institutions, and environment of each nation. The development of a country is recorded by the changes in its architecture.

During the last twenty years a great change has taken place in American architecture. Our buildings are beginning to reflect our leadership in a great industrial epoch. Most building materials are machine-made, and many are machine assembled. Soon entire wall sections will be manufactured ready for erection at the job. The day of the individual craftsman has passed; so also has passed the day when buildings should appear as the work of craftsmen.

A great change has also taken place in architects' thinking. After re-creating Greek, Roman, medieval, Renaissance, Georgian and all other known architectural styles for the edification of the public, the architects of this country finally tired of displaying their "book learning" and got busy with the creative development of an architecture to take advantage of our amazing industrial and inventive progress.

Naturally, some earlier efforts in this direction were very crude, and startled a public accustomed to viewing buildings garbed in the raiment of bygone days. By the beginning of the war, however, the movement toward a rational functionalized architecture was nation-wide, and it was clearly evident that at last American building would truthfully reflect the free development of the greatest industrial nation the world has ever known.

The war will stimulate the development of many new products which will be used in the buildings of tomorrow. It will accelerate the production and lower the cost of many materials, the use of which have heretofore been restricted by monopolistic control of production. There will be great rivalry for tomorrow's building market, with a flood of new products to compete with the old for use in our school buildings.

Factors Influencing Tomorrow's School Buildings

Unless financial interests concerned about their investments in urban real estate are able to control the natural shifting of the middle class from the cities to the suburbs, the end of the war will bring a sudden and intensified resumption of the decentralization of American cities. To cushion the change from a war-

Kensington Junior High School, Montgomery County, Maryland

Rhees E. Burket, Architect

The use of glass brick to solve the old classroom daylight problem gave the building its functional style. Public approval was widespread even though the school is located in the metropolitan area of Washington, D. C., where public building design is principally traditional. The Washington-Metropolitan section of the Maryland Society of Architects and the Washington Board of Trade each awarded this building certificates of merit. The citation by the jury of Award of the Board of Trade reads: "The effective use of modern materials for utilitarian purposes is particularly commendable"

time to a peace-time economy, great public and private housing programs will probably be put into effect. The public housing program will to a large extent be confined to modernization of existing city school buildings. The expected private housing (stimulated and controlled to a large extent by government) will definitely affect nearly every suburban area bordering on cities closely allied to the war effort. Permanent housing will be needed to take the place of temporary war housing near the gigantic permanent factories which have for the most part been constructed outside city limits. It is, therefore, safe to assume that most of tomorrow's school buildings will be located in the suburbs.

The stimulation of adult education by the war is apparent. Tomorrow's schools will have to provide adult training for new skills as well as for enlightenment on a multitude of subjects. Many of the communities in which the new schools will be erected will lack facilities for general community use. It will be insisted that new school buildings be planned to accommodate not only an expanded and diversified child education program, but also all adult community activities.

School building plans will be greatly affected by the realization, so forcibly brought to focus by the war training program, that education cannot be restricted to the classroom. For every subject taught, there should be a work-shop or an indoor or outdoor laboratory. The educational patterns set by the CCC and the NYA demonstrated even before the war the lack, in public educational systems, of adequate facilities and curricula for learning by doing. Many of the educational functions of the CCC and NYA programs must be incorporated in public school programs.

The war has also drawn attention to the necessity for expanding health-building facilities. The amount of both indoor and outdoor space devoted to physical education will be increased; child health clinics will become a universal school requirement. The adults of the community should make use of all athletic facilities, and the school should become the center for out-of-class recreation for the students.

Even greater emphasis than in the past will be placed on the conservation of eyesight. The improper handling of shades or venetian blinds, so prevalent in our schools, should no longer be permitted. To secure proper lighting at all times, the control of light must be taken out of the hands of the busy teacher. Proper day and artificial lighting may both be obtained automatically.

The nursery school or child day-care center will be an integral part of many schools in the post-war period.

The amount of money available for school plant development and operation is a potent factor in determining the type and size of buildings to be constructed. As nearly every means of indirect taxation will be used to the limit in the post-war period to defray the war debt, suburban schools will, in all probability, have to continue in most localities to depend on real estate taxes for their revenue. Taxable real estate in the suburbs will be from 90% to 95% residential or rural farm property; there will be little of the commercial or industrial property that helps to support urban school systems. Most of the homes to be built will be in medium-to-low-cost bracket, and the ratio of total assessable property valuation per school child will probably be very low compared to most urban centers. This situation will make it extremely difficult to secure sufficient funds locally. Funds which are secured must be made to provide the

Typical Classroom, Kensington Junior High School

The arrangement and type of glass areas used for day lighting, together with automatic control of electric lighting, almost entirely eliminate the human factor from the control of adequate light

LEGEND

1 Diffusing and directional day lighting panel
1A Majority of daylight directed upward
1B In rooms with unilateral day lighting, sloping ceilings will help lighting of inner portions of rooms
1C Downward light diffused without glare, direct sunlight on desks eliminated
2 Vision strip of clear glazed ventilating sash
2A Shades required only on vision strip; general room lighting not materially affected by their use
3 Fluorescent electric lighting fixtures with diffusing glass bottom and sides —inner and outer rows controlled automatically by photo-electric device
4 Corridors adequately lighted by almost continuous borrowed light strips above lockers
5 Class work exhibit shelf
6 Insulated floor slabs—important that upper slab be insulated from exterior wall
7 Heating and ventilating units, automatically controlled

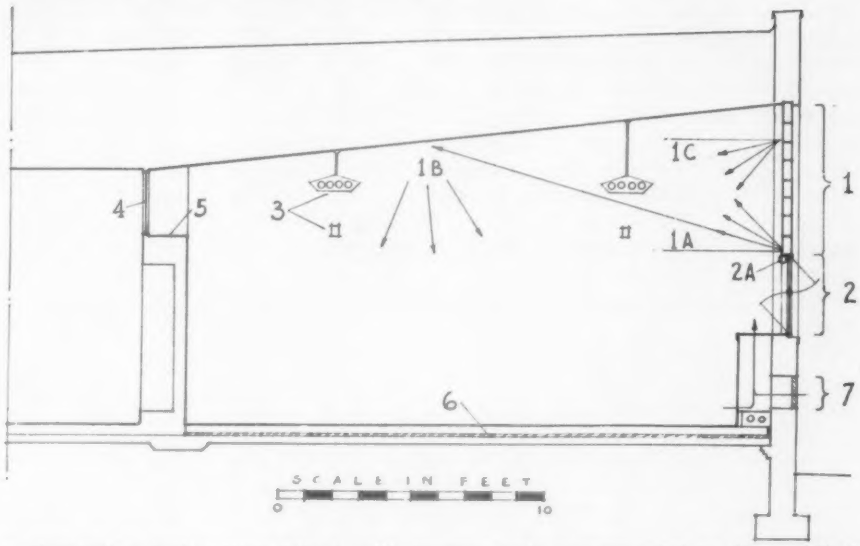


Diagram of classroom lighting system used in Kensington Junior High School, with improvements recommended by the architect after study of four years' use of the building *

most building space per dollar that is consistent with sound construction.

The Challenge to the Architect

In developed urban communities plans will center around the modernization of buildings and grounds to accommodate the diversified and expanded educational needs of the children, to provide greatly expanded adult education facilities, and to make provision for increased community use of the schools. This may not be too difficult, for adequate funds should be available. Trends seem to indicate that city school populations are decreasing; the space for new activities, therefore, may be obtained by conversion. Where enlargement of buildings is necessary, construction will in most cases follow the pattern established by the existing building.

In rural communities continuation of the movement to consolidated schools seems assured. Where there is new rural school construction, it may be handled in much the same manner as suburban building.

In suburban communities the impact of the building problem will be the greatest. The post-war movement to the suburbs will be made largely by the middle class, which demands the best in public education for its children, desires adult education in the schools, and demands that school buildings and grounds be planned and made available for community activities of all sorts. In these communities the need for buildings will multiply almost overnight; and it is here that it will be most difficult to obtain adequate funds. Every dollar will have to buy twice the amount it provided before the war.

War's Contribution of Materials to Aid the Architect.—The homely adage, "It's an ill wind that blows nobody good," may well apply to the results of the war on the building industry. Many harmful controls on production of materials will be swept away and a multitude of improved and new products will be developed. Building material manufacturers who have been manufacturing war materials will be back on the market with improved materials at lowered cost in

* To appreciate the new arrangement and its advantages, one must be familiar with the advances made in classroom lighting, and with the imperfections and difficulties of methods customarily used up to this time.

The study of proper classroom day lighting is one that has engaged the architectural and teaching professions for decades.

One of the first principles discovered was that light penetration to the far side of the rooms depended to a large extent upon the height of the top of the windows from the floor. Window heads were placed closer and closer to the ceiling, and many states and cities adopted regulations requiring the tops of sashes to be not less than twelve feet above the floor in standard width classrooms.

The proportion of glass area to floor area was also carefully studied, and regulations requiring a minimum of 20% glass area to the total floor area were widely adopted.

Next, the width of piers between the windows, and the transom bars, received study and criticism, as these cast objectionable shadows. Many regulations do not allow transom bars, and suggest that piers and mullions be as small as possible in width and depth.

As window area and height increased, the problems created by glare and direct sunlight also increased. Various arrangements of shades and Venetian blinds were used in an attempt to prevent glare and, at the same time, to permit sufficient light penetration to the desks on the far side of the room. The best arrangements discovered to date have left much to be desired. One of the principle obstacles which has proved almost insurmountable has been that shades or blinds drawn to exclude sunlight or glare are usually left drawn, although the reason for their being drawn no longer exists.

A survey of a number of schools, conducted on overcast days, revealed that in practically all classrooms the shades or blinds were drawn over twenty-five to sixty percent of the window area, with the result that in nearly all cases one third or more of the desks were supplied with inadequate light. In other rooms electric lights were turned on, although when the shades were raised no artificial illumination was needed.

Because of the human element involved, the matter of adjustment of shades or blinds is perhaps the hardest problem connected with proper day-lighting of classrooms. Teachers and students absorbed in the work of the class seem invariably to overlook the need for reduction in glare or the need for added light until the situation becomes unbearable, which is usually long after the actual need for adjustment was created.

In 1925, seventeen years ago, the National Education Association's Committee on School House Planning published an exhaustive analysis of all phases of classroom lighting. This report concluded "that even the buildings which were constructed in accordance with prevailing standards of glass area (20%) give deficient illumination in the darker parts of the room, under the less favorable conditions of season, weather, and time of day. When the unfavorable conditions combine, the illumination may be ridiculously low. It may be safely said that in the winter season the dark desks are inadequately lighted for a considerable part of the time."

In considering remedial measures which could be adopted in new school construction, the Committee made two practical recommendations: "To find some method of diffusing light toward the back of the room;" and "To supplement daylight illumination by means of artificial light on the darker side of the room."

In conclusion the Committee made the following observation: "Finally a word should be said in regard to the use of window shades. In many rooms tested the shades were found to be drawn down and the illumination was found to be unsatisfactory. In many cases there was no direct sunshine in the room and it was not necessary to have the shades drawn down. It is, therefore, necessary that the teachers be instructed on the possible harm of drawing down the shades and that their practice in this matter be watched."

In the seventeen years that have elapsed since the publication and wide distribution of the report referred to, little or no progress has been made along the lines recommended. The only improvement has been to control the inner row of light fixtures by a separate switch. Schools continue to be built with wide brick piers between windows; shades or blinds are installed and neglected, and a considerable number of students in each class suffer eye-strain which may impair their vision permanently.

order to regain their pre-war status. A few of the materials expected are long-life insulated wall panels; cheaper aluminum and other alloys for framing, sashes, doors, sills, copings, etc.; plastics in sheet or moulded form; self-contained electric room heaters and conditioners; improved diffusing and directional glass block; cheaper fluorescent lighting; improved electric devices for control of electric lighting; greater abundance of electric power at lower prices; and other structural and mechanical devices, many of which have not as yet been thought of.

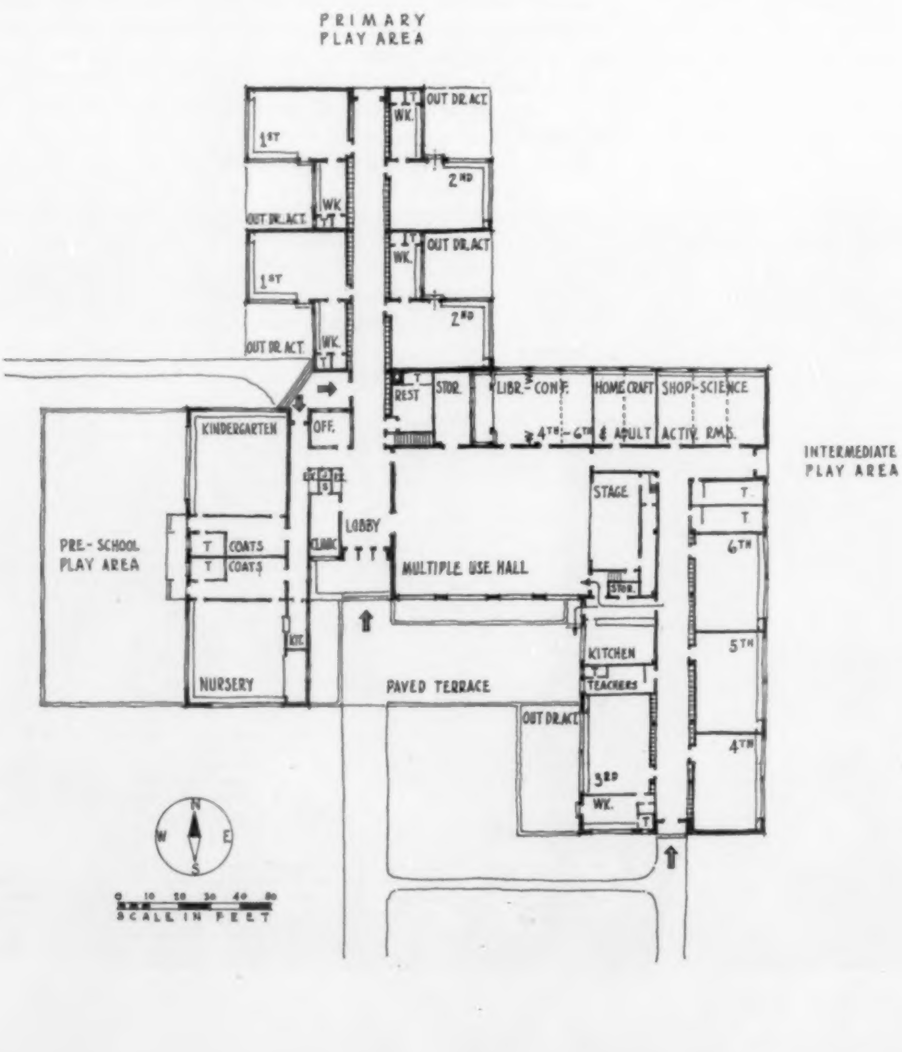
Types of Buildings to Meet the Challenge.—In discussing types of school buildings for tomorrow's needs, it may seem to be putting the cart before the horse to deal first with appearance. Illogical as this may seem to the educator who thinks in terms of educational facilities, and absurd as it may seem to the majority of architects who know full well that form follows function, there must nevertheless be a clear understanding of the part architectural design will play in the success or failure of that undertaking.

The historic architectural styles are greatly dependent for successful duplication upon craftsmanship and hand labor. They were developed prior to the machine age, in the days of cheap and abundant labor. The high cost of indulging the whim for a school of "true" Williamsburg Colonial or other traditional style is only one, and perhaps the least serious, drawback to the use of any "period" design.

If the architect is to solve successfully the problem of providing suitable school buildings which are not rated obsolete before their completion, he must be given every encouragement to take advantage of technological developments in manufactured products and construction methods. Such an excellent new product as diffusing and directional glass blocks may not be used to solve the old problem of proper natural classroom lighting if the architect is forced to provide a school of Colonial or Tudor English style. Not only is the use of modern improved materials restricted by predetermination of style, but proper and economical arrangement of plan functions or parts is greatly hampered.

A gradual realization on the part of school authorities of the disadvantages inherent in school designs of the traditional types, and a more rapid acceptance by the public of the functionalized architectural design of the last five years has freed the architect to meet the post-war challenge with a real contribution to American education and architectural development.

There cannot and should not be any standardization of plan types. Arrangement of spaces should be the result of space function and inter-relationship of activities, together with studied association of indoor to outdoor areas. Site planning should proceed simultaneously with building planning. Successful school plans will result from the proper integration of a community of segregated functions, either joined for rea-



Community Elementary School Plan

Drawn by the author to illustrate the latitude of arrangement permitted in the integration of a community of segregated functions, which is possible only where the architect is freed from the necessity of planning to fit a traditionalized exterior design

Areas planned for adult as well as student use: lobby, multiple use hall, stage, kitchen, library, conference, home craft, shop science, toilets

Folding partition may be used to combine library-conference space. Relocatable partitions may adjust size of activity space

Arrangement of pre-school and primary departments adapted from Crow Island School, Winnetka, Ill.

sons of economy, or in separate structures with each function intimately accessible to related outdoor activities.

Each instruction space will have its adjoining work space. Multi-use spaces which may be joined together for use of larger groups will be widely adopted. Easily relocated dividing partitions will be widely used to permit annual allocation of space as required by class enrolment, and as may be necessary to adopt space to curriculum changes. The big problem will be fitting the expanded requirements of diversified use to restricted building budgets. The architect must not, therefore, also be handicapped by the necessity of fitting a traditionalized exterior design.

Some construction features which may be widely adopted include the use of one-story structures of non-masonry construction, insulated concrete floor slabs laid directly on the ground, elimination of all basements and attic spaces, dry-wall construction, greater use of insulation to reduce heat losses, elimination of all wall-bearing partitions by the use of steel or aluminum framing of cantilever type to permit rearrangement of space, the use of prefabricated exterior wall and partition panels, and the use of diffusing and directional glass block coupled with automatic control of electric lights. If lower electric rates prevail, the use of individual electric room heaters and conditioners will be widely adopted. If central heating is used, heating plant may well be centrally located and exposed to view for educational purposes.

What atmosphere will prevail in our schools of tomorrow? There has been considerable muddy thinking concerning this word. The catch phrase, "homelike atmosphere," has been used, and naturally has wide appeal. The function of our schools is to prepare our children for life. Instruction and practice in home arts are essential for all. Nevertheless, for all male and for many female students the school is the training ground for a business career. It may be advisable to create a so-called "homelike" atmosphere in the classrooms of the primary grades, but as soon as the student has grown beyond this stage it is important that everything about the school should instill in his mind the value of efficiency and orderliness. The entire school building should present a businesslike appearance and be maintained in a businesslike way. A school work room or shop should have the atmosphere of a well-run shop of a similar type. There need be no austerity or coldness, but warmth, light, and intimacy. These can be obtained by color, materials, and objects of interest to each age group, in an over-all atmosphere of clean efficiency.

Retarding Factors

Several factors, which in the past have exerted a retarding influence on progressive school building planning, will continue to hamper the efforts of forward-looking educators to meet the educational needs of their communities.

Local building codes are slow to recognize new methods of satisfactory construction. State regulations governing school construction are apt to be antiquated. In some instances they are not broad basic controls, but detailed lists of commandments which practically freeze new school building construction at the level existing when they were written. Fortunately, these laws and regulations can be changed. If one of our progressive universities interested in national education standards would undertake at this time a serious study of all state regulations governing school construction, publishing their findings, it would greatly assist in solving tomorrow's school building problem.

School-board members are usually laymen who have not had the occasion or opportunity to acquire either a broad or detailed knowledge of the specialized field of school planning. On most educational matters they are content to leave decisions to their school superintendents, but when a new school building is contemplated, each member is apt to have ideas about the type of building which should be built. The one person, in addition to the school superintendent, whose intimate knowledge of educational problems and school buildings is vital to the successful completion of a new educational building is the architect. Far too often the selection of the architect is influenced by political or personal connections. Only competent, progressive architects with a broad knowledge of advanced educational methods and building construction can successfully design schools.

Questions to School Officials

School buildings of some sort will be built, there is no question about that. The question is, what sort?

Will they be barely adequate to provide each child with a seat, in the good old-fashioned way, or will the new building permit an educational program which will give every student an opportunity equal to that offered by the highest-caliber public schools? Will the buildings provide adequately for community use, or will the adults who use the schools have to adapt themselves to space and equipment designed for children? Will the buildings permit curriculum changes and rearrangement of space? Will the buildings be designed for the best possible day lighting? Will the children be able to take pride in an up-to-date school building, or will it be just another school to them?

These are just a few of the host of questions which school officials, responsible for meeting the school needs of tomorrow, must answer. If the answer is "inadequate funds to meet the real needs," an analysis of the proposed building plans is certainly in order. This may reveal that a surprisingly large sum of money is to be spent for an impressive building design as a monument to the community. If a restrained functional design and simplified structure is substituted, the available funds will be sufficient to more nearly meet the educational needs, and the resulting building will be a community monument to good judgment and propriety.

THE COMMUNITY WILL USE TOMORROW'S SCHOOLS

By HERBERT J. POWELL

Marsh, Smith & Powell, Architects, Los Angeles, Calif.

THE modern American community is asking that its schools be more than schools. Especially in suburban areas is it demanded that the school serve as town hall, lecture room, little theater, music hall, community dance pavilion, library, Boy or Girl Scout cabin, and more recently, war-work center. That is, this demand is made of those schools that can step up and say to the community, "We'll take care of your needs." To the other schools that can't so serve—well, they are not the schools of tomorrow; for, in my opinion, there will be an increase rather than a decrease in community uses for schools. School districts and officials, as well as school architects, must take this trend into account.

The most natural field for the development of this community use of the school is in Suburbia. The large metropolitan schools, and the small rural schools of one or two classrooms, have their special and separate problems.

The most efficient use of the school as a center of community activity can be made in the satellite communities of large cities and towns of 10,000 population or less; and the planners of the school of tomorrow will do well to consider this matter most thoughtfully.

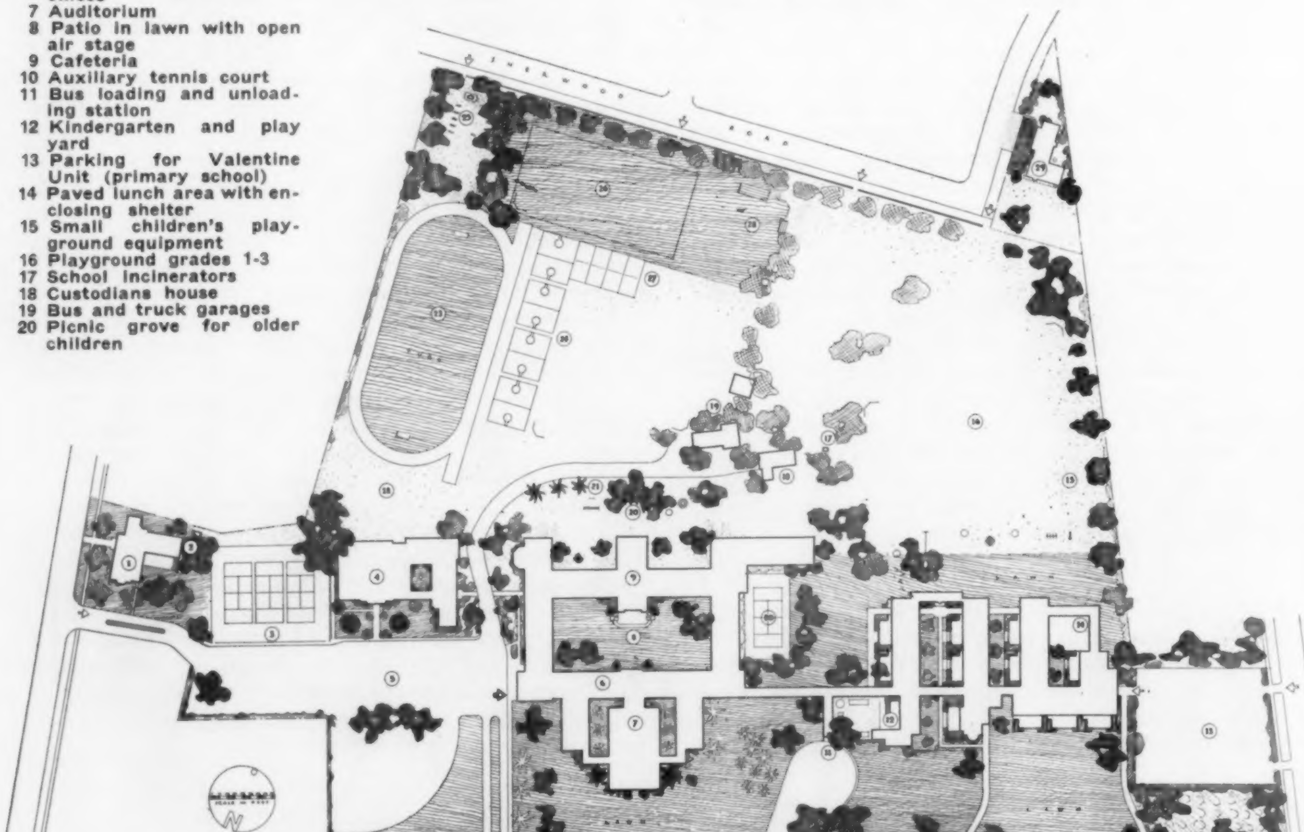
An Example of a Community-Serving School

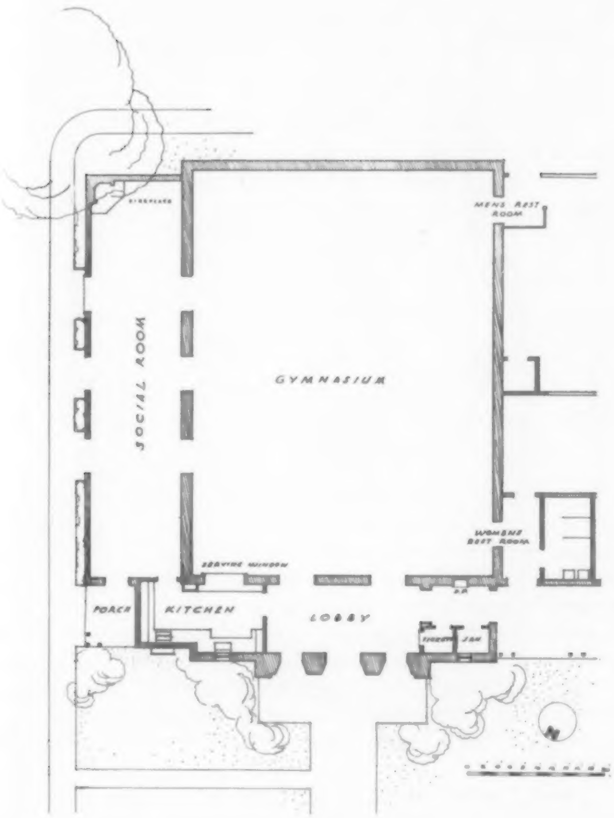
The Henry E. Huntington School of San Marino, California, is such a community center school. One hundred and sixty-eight non-school meetings were scheduled in its buildings and grounds for the month of November, 1942, according to the superintendent of schools, Mr. Elmer Neher. And far from avoiding

Site Plan—Henry E. Huntington School San Marino, Calif.

LEGEND

1 Community library—used by school
2 Pre-school room with terrace, play space, and playhouse
3 Night lighted concrete tennis courts
4 Gymnasium with social room and kitchenette adjoining
5 General parking area
6 School administrative offices
7 Auditorium
8 Patio in lawn with open air stage
9 Cafeteria
10 Auxiliary tennis court
11 Bus loading and unloading station
12 Kindergarten and play yard
13 Parking for Valentine Unit (primary school)
14 Paved lunch area with enclosing shelter
15 Small children's playground equipment
16 Playground grades 1-3
17 School incinerators
18 Custodians house
19 Bus and truck garages
20 Picnic grove for older children
21 Older children's playground equipment
22 Bicycle parking area
23 Turfed athletic field with running track
24 Basket ball courts
25 Picnic grove and barbecue
26 Football field turf
27 Badminton courts
28 Softball diamond in turf
29 Girl Scout cabin





Detail plan of the Henry E. Huntington School gymnasium. Note the provisions for community use

community uses of the school as inconveniences to the janitors and headaches to the staff, Mr. Neher and his personnel welcome the wide community participation, and are proud of the school's unique community service record.

The school is divided into a kindergarten and primary unit (grades 1 to 3 inclusive), called the W. L. Valentine Unit, with its own separate P.T.A. organization; and the Henry E. Huntington School, with grades 4 to 8 inclusive.

The population of San Marino is approximately 9,000 and is largely professional in character. The community adjoins Pasadena on its north and South Pasadena on its west.

Study of the site plan and the legend show the disposition of most of the features that will be mentioned in this article.

A Checklist for Developing a Community School

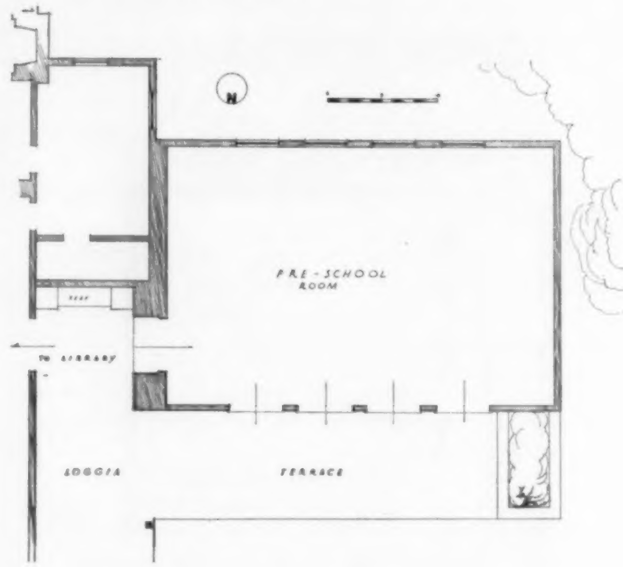
In addition to considering the requirements of school pupils, the various portions of the building and grounds should be planned for the well-being and use of the community. Following are some items that must be checked for the school of tomorrow:

The Auditorium.—This section of the school will be used not only for lectures and musical programs, but for Father's Night extravaganzas, for meetings in the interest of public information, and for forums, not to mention the many daytime meetings for mothers. If the auditorium is small and flat-floored, provide a kitchenette adjacent. Make the lighting easy on the eyes.

The Lobby.—The auditorium lobby may well occupy a non-axial relation to the auditorium; in which case it may become more informal and more spacious, with walls suitable for hanging paintings. With careful placing of furniture, and with lighting and even floor covering, such a room can become amazingly attrac-

Left—Mall of the W. L. Valentine Unit Henry E. Huntington School. There is a fountain at one end of the area

Right—Patio and Open-Air Theater Henry E. Huntington School



Pre-school room with a play terrace. This is attached to the community library of the school

tive, taking away the curse of institutionalism. This has been brilliantly done in one or two recently built schools.

The Gymnasium.—In addition to providing for night games of badminton and volleyball, the gymnasium, if ideally planned, will have a social room and kitchenette for community parties and dances; plenty of electric outlets for lighting effects, and easy access to restrooms.

The Cafeteria.—If the cafeteria has been properly planned and is an attractive room, community organization dinners of all sorts will be held here. People always prefer to eat in pleasant surroundings. City clubs and community organizations without buildings of their own all call on the school cafeteria. Acoustical treatment is a "must."

The Library.—In some communities the town library may, by special arrangement, be located on the school grounds. Entire classes can use the library during the daytime when general public use is light; and many reference books furnished by the library need not be purchased by the schools. A double use of both building and books is the result.

Special Rooms.—For night adult courses, and, more recently, civilian defense courses, one or two larger rooms are needed, easily accessible without opening the whole school. These rooms can be heated independently of the central heating system but cross-connected to it.

Pre-School Room.—A complete education program will provide a room for classes in pre-school education. This will accommodate children from two years of age to kindergarten age, as well as their mothers. A model playhouse with furniture and dishes is a desirable part of the equipment.

Outdoor Recreation.—Lighted tennis courts will always furnish enjoyment and exercise to a segment of the community. Illuminated softball fields take care of the recreational needs of still another group. Grass turf fields reduce bruises and abrasions on knees and elbows.

Scout Cabin.—A cabin for the use of Boy and Girl Scouts, Hi Y, or other youth organizations, built with community cooperation, can well be on the school grounds, provided the site is large enough to permit the location of the cabin on an isolated section of the grounds. Such separation is necessary and desirable.

Open-Air Theater.—In climates sufficiently mild, a

Right—Entrance to W. L. Valentine Unit. This unit accommodates the kindergarten and primary grades of the Henry E. Huntington School

Left—Exterior of the Gymnasium Henry E. Huntington School. The building has been planned with community use in mind

beautiful effect may be obtained by designing a portion of the school around a patio with an open-air stage on one side. Masques, pageants, dances, and outdoor musicales gain added impressiveness when performed with an entourage of lawns and trees.

Picnic Grove and Barbecue. — In the warmer months of the year, it is the practice of many schools to hold carnivals, circuses, open-house days, or similar events. The entire community is invited and the afternoon and evening are spent in visiting, viewing exhibits, and wandering over the grounds. If a grove of trees is equipped with picnic benches, a barbecue pit, water and equipment for waste disposal, a fine spot for the evening meal will result. It is the addition of such aids to enjoyable community living that often makes an event an annual tradition. Their lack may mean the loss of community interest and the reduction of community activity.

School-Community Swimming Pool. — A school swimming pool can serve the community during the summer, tying in with the community recreation program. During the school year courses in swimming and life-saving can be given. As numbers of schools have proven, the financial problem of maintaining a swimming pool is not insurmountable, nor is the matter of supervision too difficult. The pool should be enclosed with a high wire fence as a supervision aid.

Adequate Parking Space.—The wide use of the automobile in connection with community attendance at school events poses a problem of off-street parking. The average school fails to grapple with the matter. Parking should be provided close to those areas of most constant community use. If more than one area is required, they should be furnished. Often there may be separate parking for buses. Control of circulation in and out of the parking area should be carefully planned.

Planning for Community Use Is Practical

All of this provision for community use may sound Utopian. To the degree that it does, our sense of community values is deficient. All the planning and construction need not be developed at one time—in fact, sound financing will undoubtedly distribute such developments over a period of time. But to make such community use of schools possible, two things are needed: *first,* the acquisition of sufficient land for grounds—not 2 or 3 acres, but for schools of 500 to 1,000 pupils, sites of 15, 20, and even 25 acres. *Second,* a sound, workable site plan must be made, upon which the development of the school can proceed in an orderly fashion; a plan which has sufficient logic and practicality about it to recommend it to the changing personnel of school boards.

COMMUNITY SCHOOLS BUILT IN WARTIME

Yardsticks by Which We May Measure Progress

By JOHN LYON REID

Franklin & Kump & Associates, Architects, San Francisco, Calif.

THE shift of the emphasis in education from scholarship to serviceable knowledge and skills, mental and manual, has been accelerated by the war. Never before has the coordinated training of head and hands been more widely appreciated or given a higher wage premium. We used to base our educational structure on the acquisition of the three R's and on knowledge gained from books. The problem of application was secondary. We now believe that to be effective the learning process must be much more closely identified with life and its activities and problems.

The war has made us realize that our pre-war isolationism will not suffice in a post-war world. Our education will be correspondingly broadened to deal with our own complex civilization, that of our neighbor nations, and our interdependence with them. The war has made us realize that our children must be better prepared than we have been to cope with our new world.

All this will demand clear educational aims, well-coordinated teaching programs, and competent administrators and teachers. But of equal importance will be the form and character of the school buildings to house these expanded activities, and the measure of integration of the school program with the life of the community.

Preview of Post-War Construction

Since the war is in part responsible for our changed outlook on education, it is natural to look to examples of planning and building produced by the war effort to give us some clue to what we may expect after the war, and serve as yardsticks by which we may measure our progress. The United States Government has spent great sums of money on the construction of housing developments to shelter workers who have entered new war industries. Many of these dwelling units have been built in planned groups that are large enough to be considered neighborhoods or communities or even small cities in themselves. Most of them have been designed by architects, assisted by able staffs of specialists and consultants. In such efforts as these we have a right to expect intelligently planned communities which provide for a fuller life and better living conditions than exist in the unplanned cities or in most of the speculative real estate developments. Before we examine one of these projects in detail, it will be worth while for us to consider some of the factors affecting war construction.

War housing developments are the products of an emergency. In the words of Gen. Philip B. Fleming, administrator of the Federal Works Agency, "Projects not indispensable to the prosecution of the war have been shelved for the duration; those that remain have been stripped to the barest essentials." In the face of growing shortages of materials and labor, and with the need for speed in erection in order that the maximum number of defense workers can be housed quickly, many sacrifices must be made. This hardly seems the time for the realization of an ideal. However, the trend of planning, construction, and even of the evolution of our concept of the community, may be glimpsed. Especially significant for the educational profession is the role of the school program in these communities, and the provisions made to house community interests and activities.

A Self-Contained Community

One of the largest of the war housing groups is the Chabot Terrace project located near Vallejo, Calif. It is situated about three miles north of the town proper. This project has special interest because it is at such a distance that it cannot depend on the use of the community services and educational facilities existing in Vallejo, particularly since the curtailment in the use of automobiles. It must be largely a self-sufficient community, with its own stores, fire house, administration building, schools, and community facilities.

It should be explained here that at the time this article is written, all of the dwelling units of the project have been completed, and construction is well along on the store buildings, the fire house, and the administration building. Construction of the schools is expected to begin shortly.

The site of Chabot Terrace is 575 acres in size. The project is to house workers of the Mare Island Navy Yard; the site was selected because of its accessibility to the Island. Before the start of the construction, the land was used for grazing and farming. On it was one decrepit farmhouse. There were no utility services whatsoever.

The topography is one of gently rolling ground with a spine of low hills running northwest to southeast, leaving relatively flat areas in the northeast corner and in the westerly half of the property. Napa Road, on the west boundary, runs directly into the business center of Vallejo, about three miles to the south. Not shown on the master site plan is a road, running into the southwest corner of the site, which leads directly to the Mare Island Navy Yard. As most of the traffic in and out of the new housing area will be either to Vallejo or to Mare Island, the most important entrance is from the southwest and the most heavily trafficked road in the project will be road "A." This traffic pattern has a direct bearing on the location of the community schools, as will be shown later.

There are 3,000 homes in this group, which will house approximately 10,000 population for the entire project. Almost every worker in this community will be employed in the nearby Navy Yard; and partly

because of this, they and their families will constitute an unusually homogeneous community group. They have been brought together by the war crisis. Almost all of them are newcomers to Vallejo, many from distant parts of the state or from other states. They are knit together by the sharing of a common task. All are of the same general income group. The homes of all of them are similar in space, quality, and equipment. All these factors tend to merge the people into a unified group, fostering a strong community spirit. In such a group the organization of a community program in education, health, and recreation should yield large returns. This has been demonstrated by the experience gained in the operation of the nearby Carquinez Heights housing project, which has 1,700 homes and is located just south of Vallejo; this also houses Mare Island Navy Yard workers. To foster this community spirit, to minister to the community needs, and to provide for the education of the community's children, groups of school-community buildings have been designed and located in the Chabot Terrace Housing Project area.

Educational and Community Needs

The project is located in the Flosden Elementary School District, which is in charge of staffing, operating, and maintaining the schools for the benefit of the project children. This district is not in the Vallejo City School System, but is such a very near neighbor that the experience of the city in operating the school in the Carquinez Heights project was available.

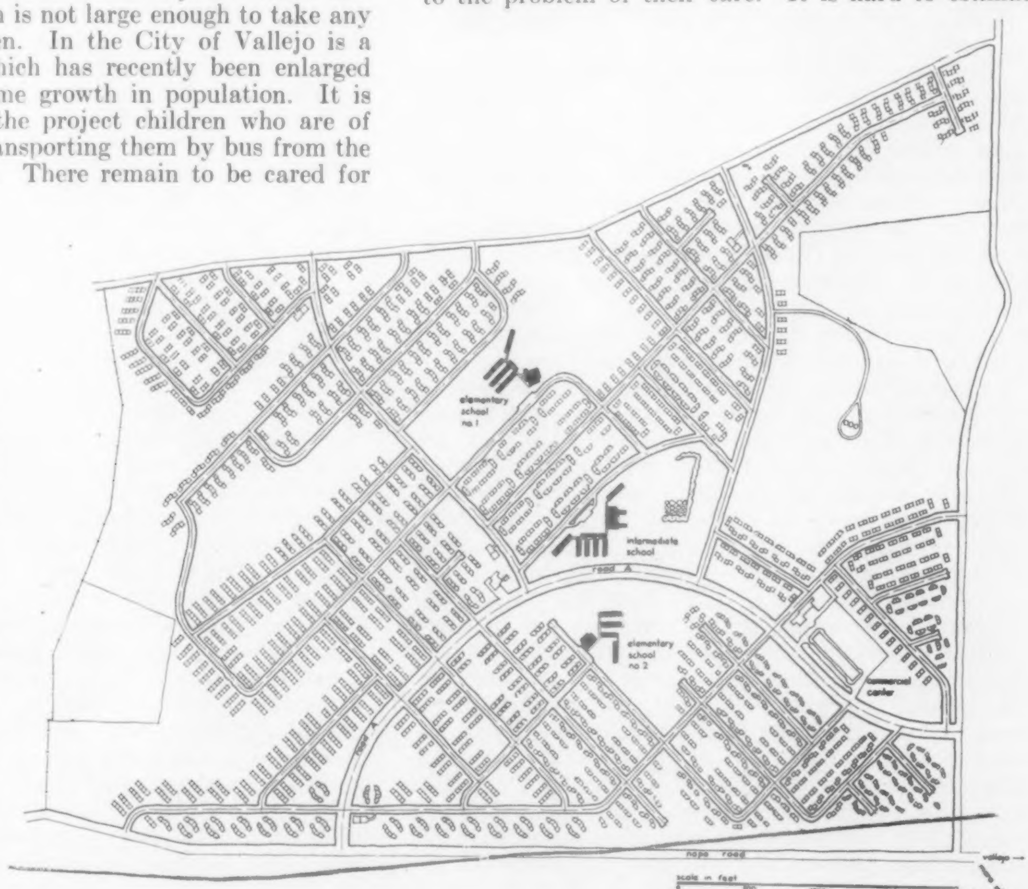
Near Chabot Terrace there is only one small elementary school, which is not large enough to take any of the project children. In the City of Vallejo is a senior high school which has recently been enlarged because of the wartime growth in population. It is possible to care for the project children who are of high-school age by transporting them by bus from the project to the school. There remain to be cared for all the children of kindergarten, elementary, and intermediate school age, as well as those of nursery school age when both parents are employed. The schools of the City of Vallejo and the neighboring areas operate on a K-6-3-3 basis.

In determining the expected number of school children, the data gathered from other housing projects, Carquinez Heights in particular, was used as reference. The population statistics of the war housing groups vary greatly from average city population figures: the former constitute a younger married group with a larger percentage of very young children.

For each home in the Carquinez Heights project there are by actual count:

- .32 children of elementary school age (6-12 years inclusive)
- .13 children of intermediate school age (13-14-15 years)
- .096 children of senior high school age (16-17-18 years)

Of interest is the fact that there are .5 children of pre-school age (1-5 years inclusive) per home, or approximately the same as the number of children of school age. In this age group a trend of great significance is beginning to show itself; and while it is a direct result of the war it cannot be expected to be forgotten after the war. This is in the number of children of nursery school age who are enrolled in school. Women are being employed in increasing numbers, and those who have very young children find that the nursery school is the only possible answer to the problem of their care. It is hard to estimate



Master Site Plan

The two elementary schools are near the center of the respective areas they serve. They are located on either side of road "A" so that a minimum number of children will have to cross this heavily trafficked road. The Intermediate School is located in the center of the project because its community facilities will be given heaviest adult use and because its pupils are drawn from the entire community. The schools are away from the heaviest traffic concentrations, which are around the main entrance roads and the commercial and administrative areas

the number of these children that will be enrolled in school. The best course to follow is to design the nursery school to be as flexible as possible, so that it may be readily expanded. The kindergarten group, likewise, is hard to estimate in size for much the same reason.

On the basis of the Carquinez Heights data the expected school population is as follows:

60 children—nursery school
120 children—kindergarten
960 children—elementary school
390 children—intermediate school
288 children—senior high school

In order to economize on the use of critical materials, the government expects schools in war housing areas to operate on a double shift basis, or at 200% capacity. Of primary importance, then, is the construction of classrooms and related facilities to accommodate a teaching program for this number of children.

Second in importance only to the need for adequate classrooms and outdoor play areas for the children are the provisions for meeting the adult needs of the community. The adult needs spring in general from these activities:

1. The meeting of large groups for lectures, dramas, socials and dances, athletic events, and dinners.
2. Smaller parties, bridge games, teas, P.T.A. and service club meetings, and Boy Scout and Camp Fire Girl meetings.
3. Organized adult instruction—classes in shop, craft work, library use, child care, cooking, sewing, etc.
4. Organized games, athletics, recreation, and picnics.

There are strong reasons for including space for these activities in the schools. The school is thereby able to bring the community closer to itself, one of the prime desiderata. There are many community activities which are barely distinguishable in kind from the activities of the child in school; and as the facilities exist for the child it is reasonable to subject these same facilities to multiple use. This obviates costly duplication of similar-use facilities at a time when cutting material and labor costs is of real importance. There are no other facilities inside the project or out which will take care of these community needs.

In making the site plan for the project, the location of the schools was given careful attention, particularly in view of the important community role they are expected to play. As the plans for the entire project —schools, commercial buildings, etc.—were prepared by the same group of architects, an unusual opportunity was at hand to achieve a carefully studied relationship between the housing, commercial, and school areas. Because of the size of the project, the number of elementary school children, and the need for distribution of the community facilities, it was decided early to have two elementary school sites. One elementary school site is located to the west of road "A" and the other to the east, so that the minimum number of children will have to cross this road. Road "A" is the main distributing road of the project and bears the heaviest traffic; it divides the project roughly into two parts, one somewhat larger than the other. The two schools are near the center of the respective areas they serve and are proportioned in size to these areas. Because of the irregularity of the ground, they had to be located where the largest level areas were available; this explains the apparently close grouping of the school plots as shown on the master site plan. The Intermediate School is located as near as practicable in the center of the project, since the community facilities it contains are more complete than in the other two schools, and since it will be given the heaviest use by the adults; likewise its pupils are drawn from the entire community. In all of the schools the entrances and parking areas are located off the main roads; the buildings proper are placed on the hilly portions to leave the level areas free for playgrounds. The school sites are away from the heaviest traffic concentrations, which are around the main entrance roads and the commercial and administrative areas.

The Intermediate School

The Intermediate School is designed to accommodate about 400 students in the 7th, 8th, and 9th grades, and also serve as the main community center. The buildings are pushed as far as possible towards the corner of the site to leave large open areas free for play fields. The area of this site is 17.6 acres. It is served by a minor road which leads to a parking area in front that may also, if necessary, be used to unload pupils from buses or cars. The office wing, containing the administrative offices of the school, is directly accessible to the public. It is also centrally located so that the officers may supervise easily the activities of the whole plant. In the shop-science wing, which is parallel to the front road, there are a science classroom, a mechanical drawing classroom, and a general shop. The latter is designed for woodworking, metal work, and general craft work. There is a shop yard entered from the road by a driveway that may be used both for the deliveries of shop material and for work which may be difficult to handle in the shop, such as auto repair, etc. The classrooms are arranged in a series of four parallel wings which stem from the administrative wing. The library is centrally located in one of the wings. The orientation of all these classrooms is north to provide the most desirable light for seeing tasks; and the shop-science wing is northeast.

The big multi-use room or assembly hall, 112 by 56 ft., is connected to the classroom units by an open corridor. This unit will be used almost equally by the school children and the adults, so it is located to be accessible to both groups of users. It is separated from the classroom units so that adults may use it during school hours without interfering with the classroom activities. There is a stage at one end, and the room is flanked by a small spectators' gallery and locker-shower rooms for boys and girls; behind it are band and practice rooms, located away from the classrooms because of the noise. This entire group of rooms constitutes a unit the use of which is varied, which explains the name "multi-use" room. Athletics and games, theatricals with the band and practice rooms serving as dressing rooms, large dinners with the meals served from the nearby kitchen, lectures, movies, and dances, can all be accommodated.

The farthest wing, paralleling the road, contains rooms and facilities which will probably be used more by the community adults than the pupils, hence its location away from the classroom area. Here at the

far end is the clinic for first aid, minor medical treatment and examinations, and health talks. Next to it are two meeting rooms, separated by sliding doors by which they can be opened into one big room. Just off the meeting rooms is a work room or kitchen where domestic science classes may be held and light cafeteria lunches prepared and served to school children. The meeting rooms can be used for smaller meeting groups for whom refreshments may be prepared.

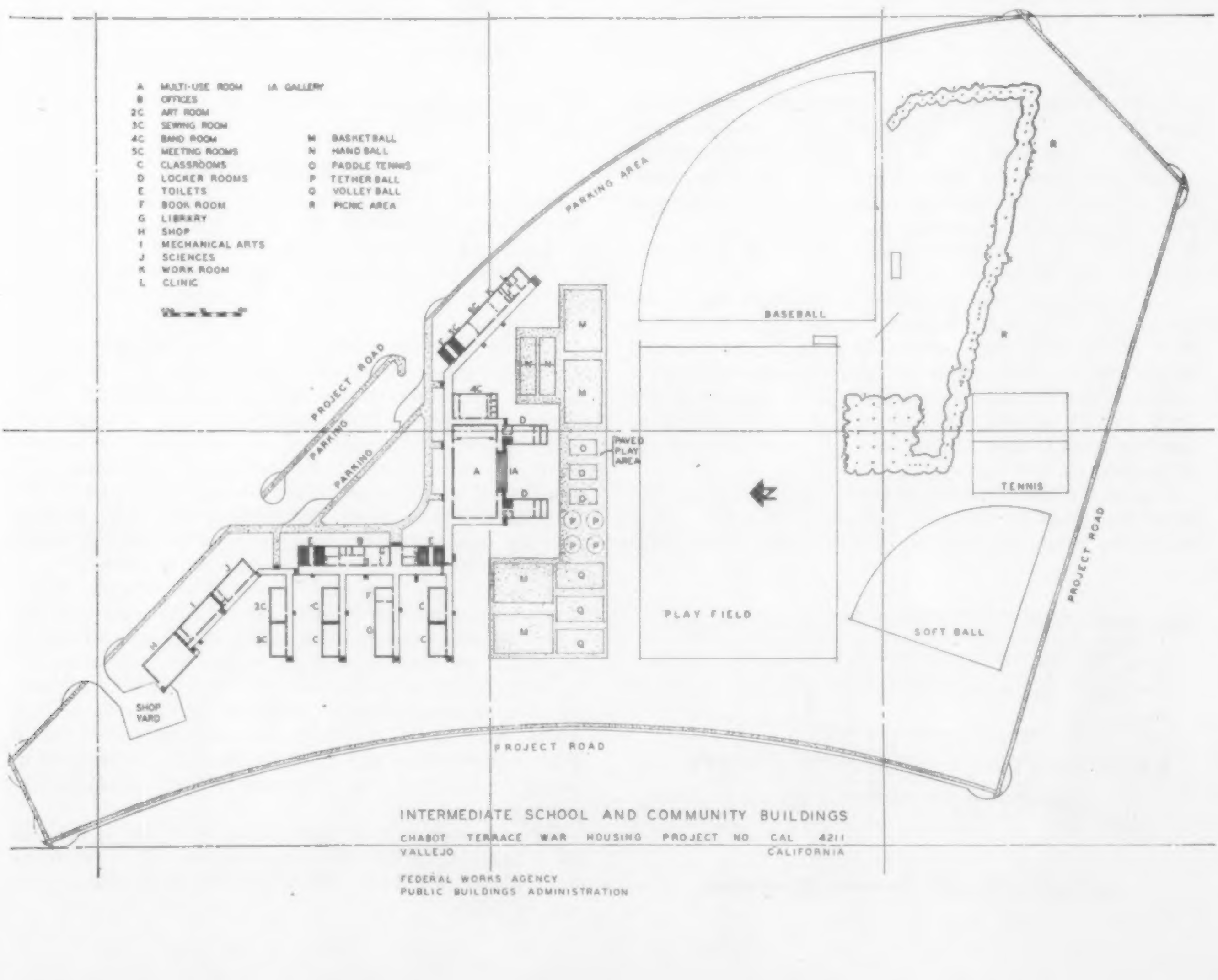
The school site has been planned for maximum play-space use for those of all ages. The locker and shower rooms have been placed so that they are directly accessible to these outdoor play areas. An area near the locker rooms has been surfaced with asphalt paving and marked off for games such as basketball, volleyball, etc. It is important to note the proportion of play area to building area; sufficient outdoor space is an essential in developing a good physical education program in the school and in securing participation by the community in a program of play.

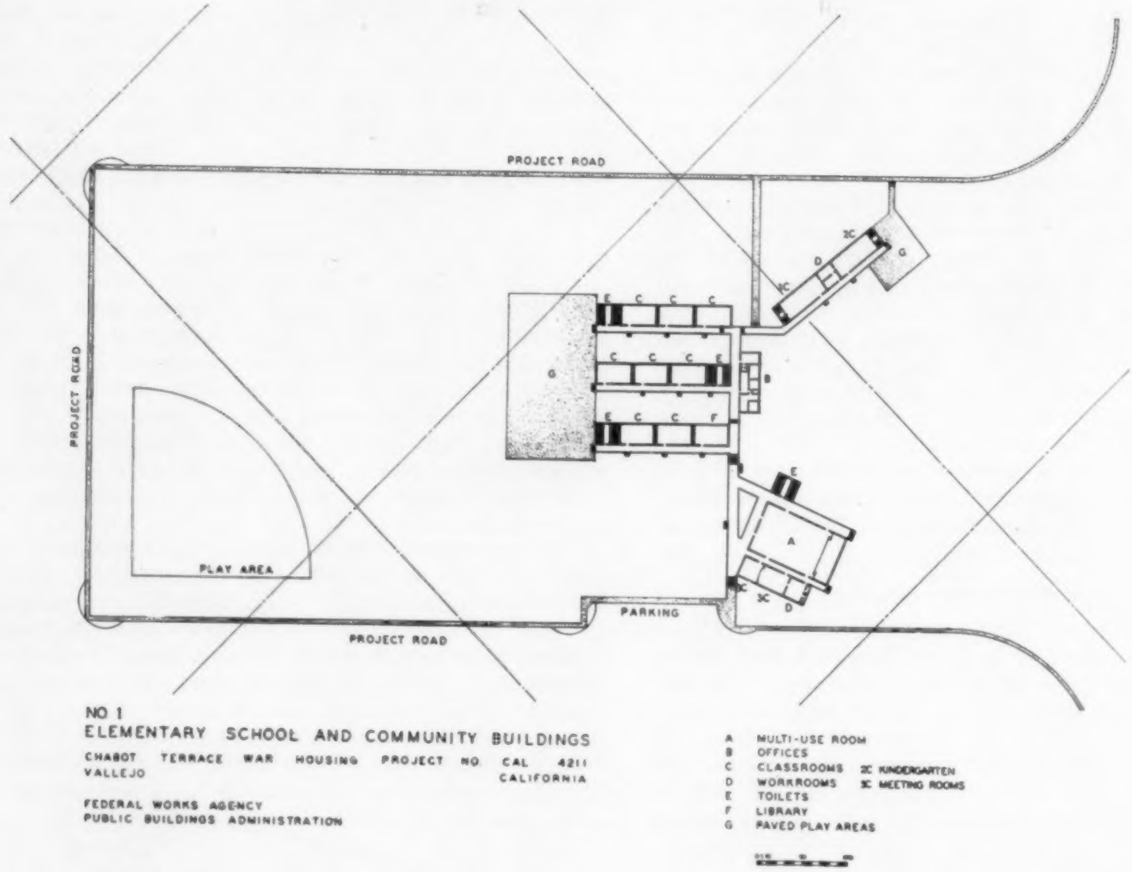
The Elementary Schools

The buildings of Elementary School Number One are located at the foot of a low hill that rises rather sharply in the southeast sector of the site. This hill accounts for the blank area on the site to the southeast of this school, where the terrain is too steep for building. By bringing the buildings against the foot of the hill the maximum area was left free for play space. The same problem of terrain affected the arrangement of the buildings of Elementary School Number Two. Here the steep ground lies in the north corner of the site and slopes down to the south, gradually levelling off into the play area. The buildings are again placed against the slope, leaving the maximum amount of level play area.

The same objectives as those of the Intermediate School governed the arrangement and relationship of the different units of building to each other, to the play areas, and to the roads. The entrances are on the minor roads. The multi-use room unit is directly accessible to the public, and also to the children from the classroom areas, for convenient use by either group. The administrative offices are centrally placed for contact with, and supervision of all the activities of, the entire plant; and the classroom units are located for correct orientation, quiet, and access to the playgrounds.

The elementary schools house the kindergarten and grades one to six. A special problem in these schools is the kindergarten unit. The necessity for flexibility in space to take care of a group of children rather unpredictable in size, was stressed earlier. The kindergarten unit has two rooms with their own toilets, and a work room or kitchen for the preparation of light meals or refreshments. One is to be used for nursery school children, one for kindergarten. If the nursery

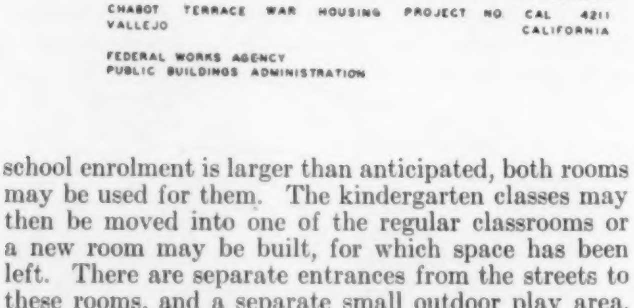




school enrolment is larger than anticipated, both rooms may be used for them. The kindergarten classes may then be moved into one of the regular classrooms or a new room may be built, for which space has been left. There are separate entrances from the streets to these rooms, and a separate small outdoor play area. A study of the elementary school plans will show how this has been achieved.

An opportunity was provided by the contours of the ground in Elementary School Number Two to have a covered open-air play space as a part of the playground area. The length of the classroom wings runs downhill so that the downhill ends of the wings are high enough above the level of the playground to provide open shelter underneath. The classrooms are supported on wood posts.

The site of Elementary School Number One is 12.7 acres and that of Number Two is 12.8 acres. Note again, as in the case of the Intermediate School, that these large sites are necessary to develop adequate facilities for play.



A Typical Chabot Terrace Classroom

Structure and Equipment

Since these schools are of emergency construction, their design presented the problem of building as cheaply and as quickly as possible without the sacrifice of anything considered essential to health and the proper teaching of an activity or work-type curriculum.

All the different buildings, such as the classrooms, the office group, the multi-use rooms, the libraries, etc., are constructed as independent building units joined together to form building wings. Because of this the greatest freedom of site arrangement is possible. It also permits flexibility in increasing the number of classrooms either during construction or afterwards. This is of importance, especially in war housing, where the original number of housing units may be increased or where initial population estimates may be in error. In each of the three schools, space has been planned for the addition of future classrooms.

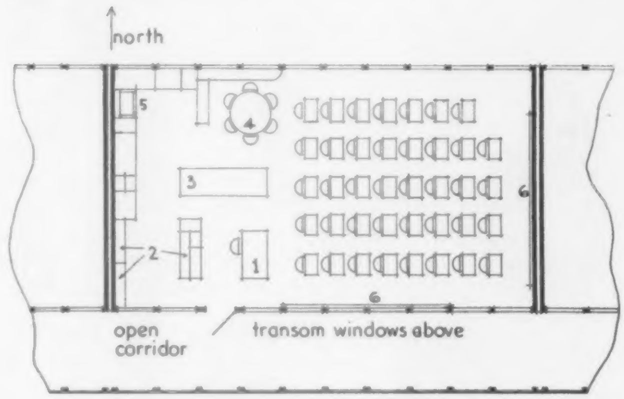
Foundations consist of a gridwork of concrete piers on which the classroom and corridor are supported by a system of wood posts and girders permitting adjustment to uneven ground. Exposed wood studs, ceiling joists, and sheathing form the interior room finish. Finish floors are pine. Exterior finish is common drop siding. Roofing is mineral-surfaced composition roofing.

The classroom wall next to the corridor is lighted by a band of continuous windows, the sill of which is 6 ft. above the floor. As this corridor is usually on

the south side of the room, the overhanging corridor roof protects this window from the glare of the sun and no window shades are needed. The wall of the classroom away from the corridor is lighted by a run of continuous windows with a sill 3 ft. above the floor. A minimum of light protection is needed for these windows also, since they face north. The head of these windows is at the ceiling line. These windows form a system of bilateral lighting that gives an even, well-diffused light on every desk in the classroom. Cross ventilation is also provided in this fashion. In the office units this bilateral lighting gives ample light to the interior offices on the corridor wall.

Classrooms are of 22- by 40-ft. net inside dimensions. Because of the bilateral lighting, it is possible to reduce the ceiling heights to 9 ft. and still obtain ample natural light, with an accompanying reduction in construction and heating costs. Construction is standardized on a 4-ft. module. All classrooms are identical in size and design, except the kindergarten rooms, which are 48 ft. long. Offices are standard classroom construction; all the interior partitions are non-structural so that office spaces may be changed if necessary.

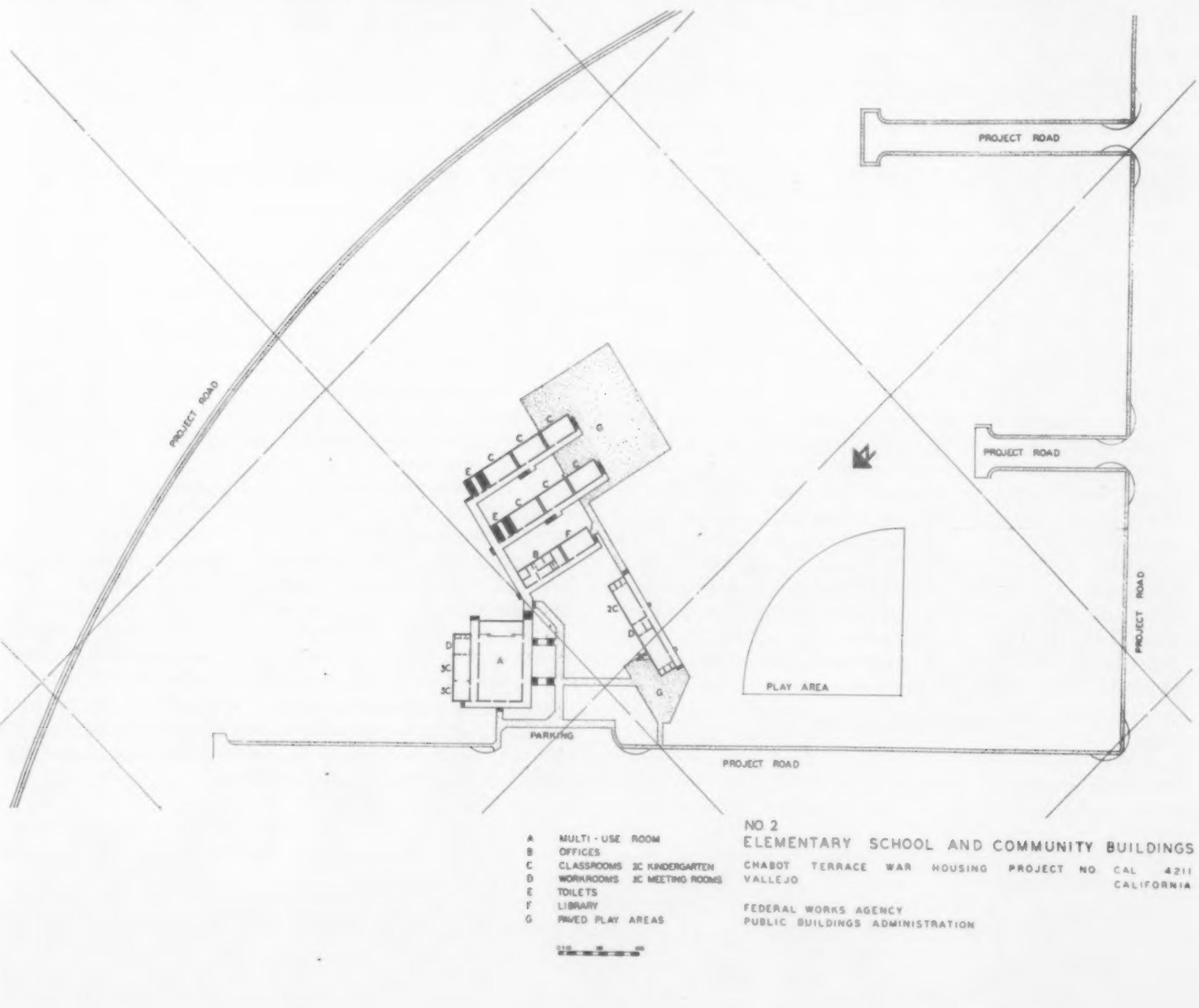
An activity program requires the use of many and varied materials by the students; these materials should be stored in the classroom. This storage space



PLAN OF CLASSROOM

1 Teacher's Desk
2 Wardrobe Storage
3 Project Table
4 Reading Table
5 Sink
6 Blackboard

should be adjacent to an ample work space; the arrangement should be such that all is under the constant supervision of the teacher. It is a great advantage if storage space and work space can be flexible in arrangement to care for changes in the teaching program or in the use of the room. Storage cabinets are built as separate units, but conforming to a system



of sizes and dimensions that makes it possible to arrange them in almost unlimited variety. They may be re-arranged with ease. The arrangement of these cabinets defines space for different kinds of activity in the classroom: work space, reading space, wardrobe space, etc.

All traffic is carried by open covered corridors with rooms on one side only. This minimizes noise nuisance. This open corridor system results in a spread-out type of planning that capitalizes on the mild California climate and brings fresh air and sunshine much closer to the children.

The multi-use rooms are all 56 ft. wide and are spanned by laminated wood arches semi-circular in shape; this is covered by wood sheathing which is exposed inside the room. Natural lighting comes from windows in the end wall which are equipped with an exterior system of wood shutters built integrally with the window and operated from the floor of the room. By the use of these shutters natural light may be controlled or completely excluded; this is useful also in blackouts. The ceiling height is sufficient to permit use of the room as a gymnasium.

Heating throughout is by means of gravity-type oil heaters, the only type of heat permitted at this time by the War Production Board.

Classroom and corridor ceilings are painted white for the maximum reflection of light. Interior walls are treated with a light stain, and all cabinets, etc., which are touched by hands are painted maroon. Exterior colors are neutral, except that of the multi-use rooms, which is red; the exterior walls of the corridors of each wing are painted with different bright colors, partly to add interest and partly to aid the smaller children in identifying them.

Thought-provocative is the fact that adequate space and facilities for teaching have been realized at a much lower cost than is usual and without in any way impeding the proper education of the child. It is true that these buildings represent the minimum cost in construction. The structural materials of any building, however, suffer relatively little depreciation through the years; an old structure is as adequate for shelter as the day it was built. Yet it is rendered obsolete through our advancing knowledge of the handling of daylight, better mechanical equipment, better educational equipment and systems, changing educational needs, etc. By reducing the cost of shelter, i.e., the cost of construction, more money can be made available for useful teaching equipment and for the hundred and one other demands of an educational program. Permanent costly schools, in a world which does and will continue to change rapidly, are a liability. The minimum construction represented by these schools is admittedly an expedient, but it may influence post-war school design.

Government Aid

The need for these schools arises solely from the construction of war housing which produces no additional school-tax revenue for the district in which they are located, except the allotment from state funds after the first year of operation. These funds are based on the student enrolment of the preceding year. The district is confronted by a real problem in schooling its new children. It is primarily a government responsibility to provide the new schools and aid in their maintenance and operation, but a responsibility of the district to staff them and administer the program.

In brief, the financing of the schools was handled as follows: The construction cost of the schools, together with the cost of equipment and furniture, was provided entirely by the U. S. Government through funds made available by the Lanham Act. The school district can bear a small part of the maintenance and operation expenses through its taxes and the state allotment. The rest of it is made up by government contribution of a fixed sum in lieu of the taxes that cannot be collected on the tax-free houses and land owned by the government, and also by maintenance and operation funds provided by the Lanham Act for this purpose. The school district leases each school from the government for **$1.00** per year.

The community-school building groups were designed by Franklin and Kump and Associates, and William Wilson Wurster, associated architects who were also responsible for the site plan of the whole project. Mark Falk served as consulting structural engineer for the schools. The constructing agency is the PWA. Valuable contributions were made by Dr. Charles Bursch, chief of the California State Division of Schoolhouse Planning, and Mr. John R. Alltucker, superintendent of the Vallejo Unified School District, in the capacity of consultants.

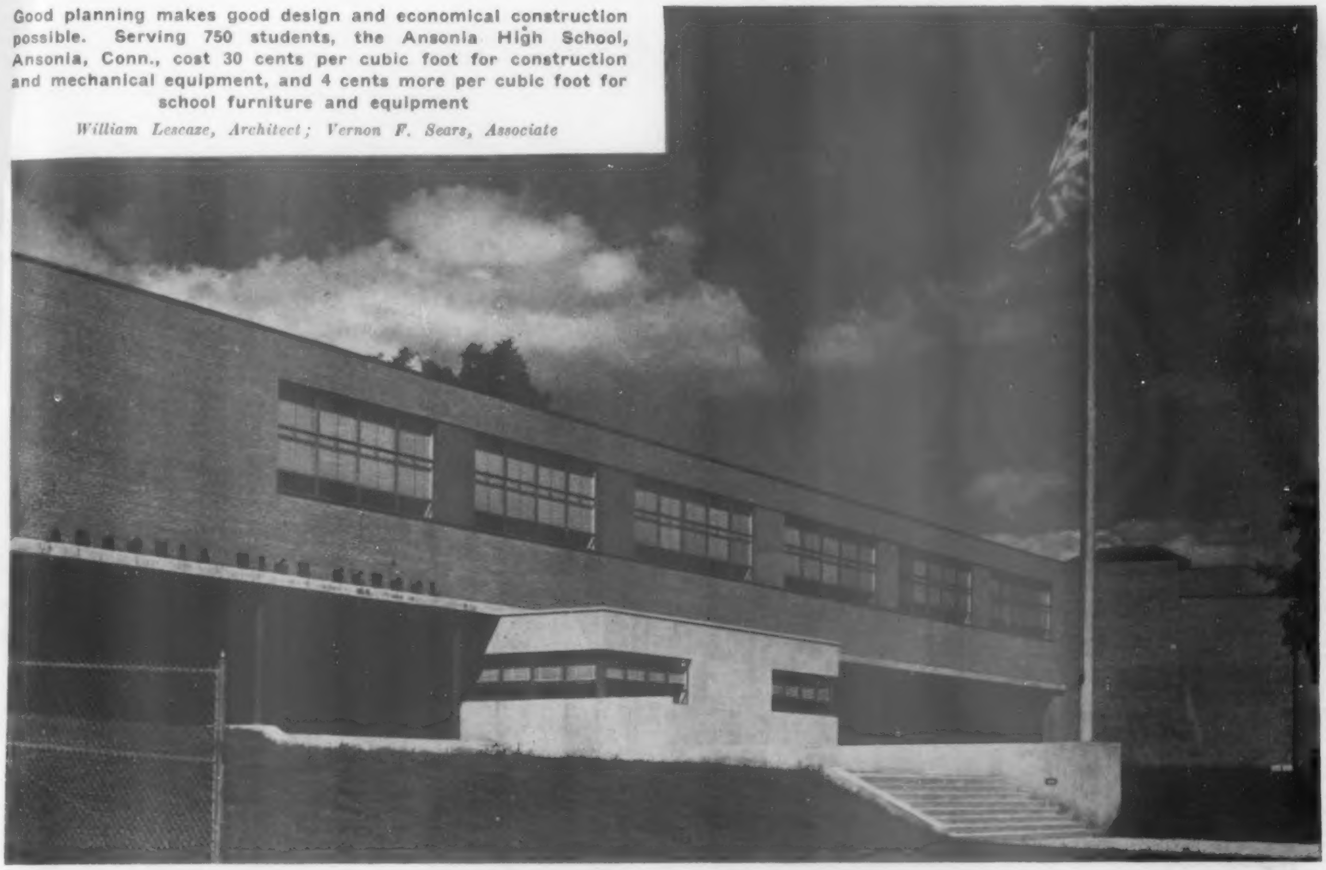
Postscript

This article was written after the plans were completed and before the construction of the school buildings had begun. The plans naturally represented the best thoughts of the teachers, consultants, and planners, and in that light they have their value as representative of a solution that answered this problem. The continually tightening restrictions on building caught up with this project, however, before the buildings could be started; and some of the units had to be eliminated.

In the Intermediate School the wing at the southeast end of the group, containing the two meeting rooms, the work room, and the clinic, was eliminated entirely. The band room and the two locker rooms just off the multi-use room were also cut off. The casualties in the two elementary schools were the loss of the two large multi-use rooms; two smaller rooms to serve the same purpose were substituted for them. Thus the effect of the war may be seen in the curtailment of the community program and of large and complete school groupings; but the resulting loss to the schools is one which will least affect the classroom teaching program for the children.

Good planning makes good design and economical construction possible. Serving 750 students, the Ansonia High School, Ansonia, Conn., cost 30 cents per cubic foot for construction and mechanical equipment, and 4 cents more per cubic foot for school furniture and equipment

William Lescaze, Architect; Vernon F. Sears, Associate



TYPES OF SCHOOLS TO SERVE TOMORROW'S NEEDS

By WILLIAM LESCAZE

Architect, New York, N. Y.

HAS the time finally come when we may call a spade a spade? If it has, then we must confess that our educational programs, much as they may still require improvement, have nevertheless progressed far in advance of the planning and design of our school buildings. To quote Lincoln, "If we but know where we are and whither we are tending we can better decide what to do and how to do it." If we are ready to admit that most of our school buildings are inferior to our educational programs, then we may at last look forward to better school buildings, well planned and well designed.

Do We Really Want Good Buildings?

A good plan and a good design always imply courage. Courage on the part of the school board, the principal and his staff (and courage too on the part of the architect). If the school board and the principal have the courage to recognize that that school building which was built in 1922, and even that other one which the neighboring town built in 1932, are pretty dismal and dull affairs, and if they have the courage to say so, then they are taking a first step in the right direction. If they follow it with a careful examination of what makes architecture and what it takes to be an architect; and if, again, they have the courage to select their architect not solely on the basis of his friendship with the town's leading personage, nor on the basis of the number of schools this architect may have previously designed, nor because he lives less than 25 miles away, but on the basis only of his ability and character, or of what he stands for (in architecture), or of what he has done, then they are taking another step in the direction of better schools. Courage, therefore, to begin with; and after that everything flows in easily.

I mentioned before that it required courage, too, on the part of the architect. Quite so. I don't like writing (I like planning, designing), and what's more, I don't at all enjoy criticizing. After all, what does it matter what I like or dislike? But what is important to me, and what I hope is important to many others, is the fundamental purpose of architecture. I would be failing to show even a particle of courage now if I did not say this: that speculating or writing or lecturing about "Types of Schools to Serve Tomorrow's Needs" is all very well but it won't get us good school buildings. It may do a little bit toward

getting some things which will approximate good buildings—but alas! in architecture, as in war, a near-hit is seldom of much more value than a dud. Have we finally reached the stage where we mean it when we say we want good school buildings—mean it seriously, earnestly—or are we merely enjoying talk and indulging in theories about them? We have been toying and talking now for over twenty years. It has gotten us jolly few good school buildings. Frankly, if we mean it seriously this time let's stop talking and let's do first the thing which should be done first: let us find a few good architects. I'll wager that there are probably right now as many good architects alive as there are buildings scheduled to be built.

To select a good architect is the simplest, the least painful, and the surest way to get a good school building. It may require some effort to pick out the best one, but not an altogether excessive effort and certainly a rewarding one worth while making.

What's true for school buildings is equally true for other types of buildings.

Responsibility of the School Board

It is an indisputable fact that our country has the architects who can create significant architecture *today* if clients, school boards, public officials, bankers, manufacturers, and captains of industry and commerce come to realize that:

1. Their responsibility toward architecture is as great as the architect's responsibility, since they are the ones who select the architect.
2. Their first step, and not their second or third, when thinking of a building, is to select an architect.
3. Their selection should be on the basis of ability and character.
4. Once their choice is made they should place every confidence in him and collaborate with him until he has become familiar with their building problem.
5. Once he has analyzed it and has suggested his solution, they should review it with him, comment on it, listen to his reasons (not try to browbeat him into doing something they, not he, think is best; not decide without his being present). He wants, as much as they do, the one thing that is right for them; and he knows better than they do how to achieve it in terms of buildings.

After all, I am not suggesting the impossible.

Why Retrogress to Obsolete Formulae?

I am not advocating change because change is good per se. I am urging it because life has changed and because we should want to prepare our children for that new world which will be theirs. Jefferson wrote, in 1816: "I am certainly not an advocate for frequent and untried laws and constitutions. . . . But I know also that laws and institutions must go hand in hand with the progress of the human mind. As that becomes more developed, more enlightened, as new dis-

Richard J. Neutra, Architect

The Corona Avenue School in Bell, Calif., illustrates a successful "bridging" between outdoors and classroom

Gymnasium, Dartington School
Devon, England

William Lescaze, Architect

coveries are made, new truths disclosed and manners and opinions change with the change of circumstances, institutions must advance also and keep pace with the times. We might as well require a man to wear still the coat which fitted him when a boy, as civilized society to remain ever under the regimen of their barbarous ancestors."

It is difficult to understand that so few people realized that for years the thoughts of modern educators and the thoughts of modern architects were closely parallel. The architects were there, ready to serve with their knowledge of design, building methods, and materials. But while educational programs would be progressing in order to meet more adequately the changing needs of life, whenever the problem of a new school building came up building committees and school boards would promptly retrogress to obsolete architectural formulae. Why? As if school buildings didn't matter, as if they were not an integral part of the educational program.

Usefulness and Beauty Are Easy to Attain

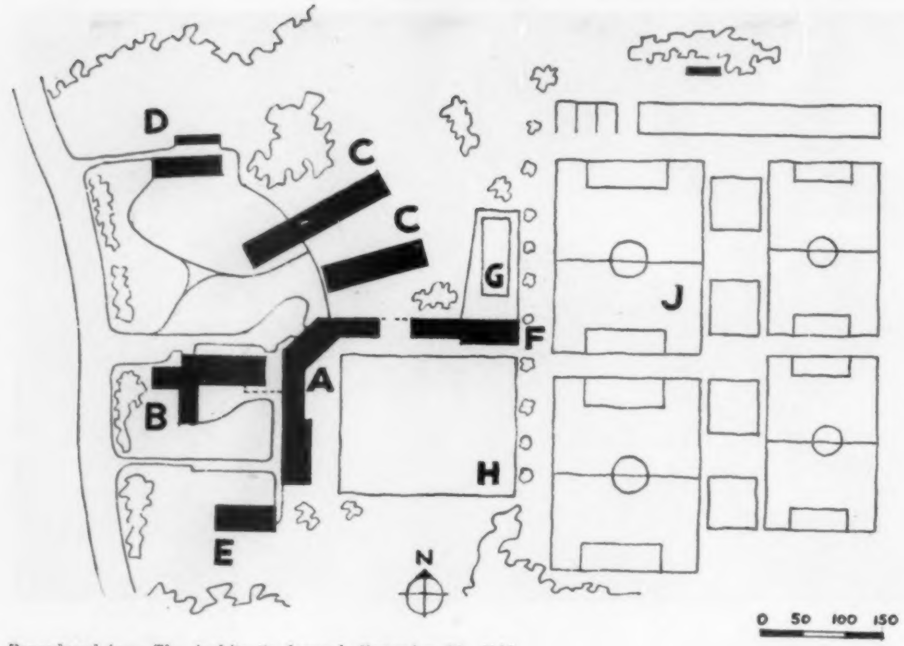
School years are "potentially the most impressionable and valuable hours of the child's life," states Mr. Carr, Director of the Research Division of the National Education Association, and he adds that "quite apart from the normal educational processes, the physical school environment during these hours is bound to make a profound impression on the growing child."

Since we know that the first years of our children's lives are so important and that their environment

Details of two schools in different climates showing different treatment of fenestration—shaded and smaller windows in the South, not shaded and larger in the Middle West

Samuel G. Wiener, Architect
High School, Bossier, La.

Lyndon & Smith, Architects
Fitzgerald School, Detroit, Mich.



Reproduced from The Architect's Journal. November 26, 1942

A flexible school layout, planned with a view to expansion and adaptability to new methods of education

makes such a profound impression on them, we should insist that our school buildings be both functional and beautiful in design.

To meet these requirements of usefulness and beauty, what should these buildings have? In a very few words:

A plan—free, easy to follow, natural, economical, designed for the life to be lived inside.

Facades which carry out that plan simply and honestly in the vertical surfaces, with order and rhythm in their windows and walls, and with windows placed in relation to the sun and to vistas.

A form making use of the natural characteristics of its site: slope, orientation, trees, etc.

A logical use of materials expressive of the plan, native to the locale, and properly arranged.

A sensible balance of costs among all items making up the total cost of that building, and a sensible relation of that cost to the number of children served and to the community as a whole.

And these things can be obtained quite simply, if we choose life instead of stagnation, right now.

Flexibility Is the Architect's Problem

Many problems, such as those of housing, air-raid precautions, town planning, schools, are different in Great Britain from what they are in the United States. Yet they have some similarities. In one part of England, since 1936, the County Architect of West Sussex, Mr. C. G. Stillman, has been designing and building "flexible" schools. To him, as to many others, education is one of the most important phases of post-war planning: to improve our material world without improving the people who live in it would indeed be a strange aberration. Mr. Stillman recommends four main points which have one single aim—flexibility—in order to make our school buildings meet more adequately the new demands of new methods of education.

1. Loose site planning and abandonment of monumental facades.
   Adaptability in the joints between wings.
   Light unit construction—in wings.
   Non-structural partitions inside wings.
2. Reduction of costs by a type of construction which shall be light and cheap enough to meet changing circumstances, but of such quality as to keep down maintenance costs. This can be achieved only by good design.
3. Planning lay-outs generously enough to allow for expansion without interference with expensive services and recreation areas.
4. Bridging the gap between outdoor freedom and classroom discipline by increased attention to landscape design and by the careful integration of buildings with their natural surroundings.

This, he states, is the architect's problem.

The accompanying layout, made for a school for 400 boys, flexible enough to allow for future developments, illustrates some of Mr. Stillman's points.

SCHOOLS ARE FOR CHILDREN

Observations on Elementary School Design[1]

By ELIZABETH B. MOCK and RUDOLF MOCK

Acting Curator of Architecture, Museum of Modern Art

Architect, Princeton, N. J.

THE average person isn't interested in architecture. He may be pleased to recognize a familiar architectural style. He may have some curiosity as to a building's size and cost or the ingenuity of its mechanical equipment, but that's about all. He doesn't *see* its forms, *feel* its space and its scale—not consciously. But these purely architectural factors are important. They affect us all *unconsciously,* and can make us feel depressed or elated, tense or relaxed, inadequate or self-confident.

Our schools have suffered from this general indifference to architecture. School boards conscientiously insist that their architects meet certain physical standards of space, sanitation, ventilation, and light. If the architect can do all this within the budget and at the same time turn out an impressive-looking monument, they are more than satisfied. *The psychological effect of the building upon the children is rarely considered.*

Architecture and Mental Health

Yet architecture itself can have positive educational value. And conversely, even the best system of education is hampered by an unsuitable setting.

Educators agree that children's needs are not only physical and intellectual, but emotional. They constantly seek new ways to encourage the development of the child's sense of unity and security, his appreciation of honesty and beauty. But they fail to realize that these qualities are affected by the child's daily surroundings as well as by his actual training.

Suitability implies more than spacious, conveniently related rooms, well equipped and well lighted.

The suitably designed school encourages the emotional well-being of the children. It is a gay, friendly place where the child can feel he belongs; where he can move in freedom, indoors and out; and finally, where he can have the very real experience of good contemporary architecture.

Some Common Faults

Look around and see how few of our schools are in this sense designed for children.

Sites are too often small, badly chosen, and drearily landscaped.

Buildings are apt to be overwhelmingly large in size and scale, institutional in atmosphere.

Children are often stuffed into drab, box-like classrooms shut off from the outside like prison cells and scarcely more attractive.

The whole is usually masked by "architecture" borrowed from other times and places, sometimes monumental, sometimes merely quaint, in either case meaningless to a child. Children are realists, quick to detect a fake.

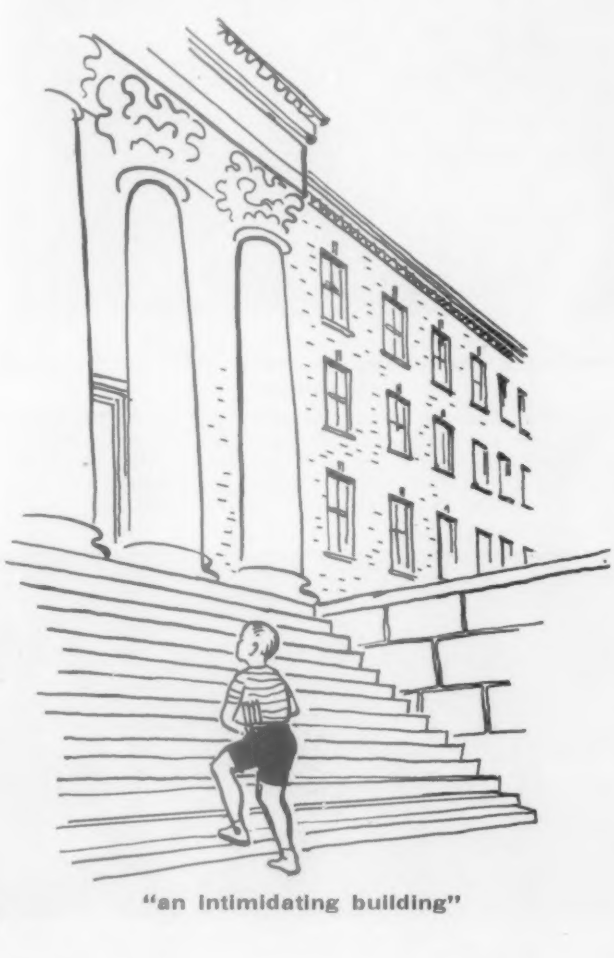
In these all-too-typical schools, even the gifted teacher works under a handicap. And it's doubly hard for shy Johnny to enter into group activities if an intimidating building contributes to his feeling of inferiority and insecurity.

These are the common faults. What, then, are the corresponding virtues? What is the positive program?

Classrooms and Common Rooms

At every step of his design, the architect should be more interested in achieving a sympathetic relationship between building and children than in conforming to his own or the school board's preconceived idea of desirable form.

The basic unit of the elementary school is the classroom, and it is here that the architect may look for the key to the ultimate shape and substance of his



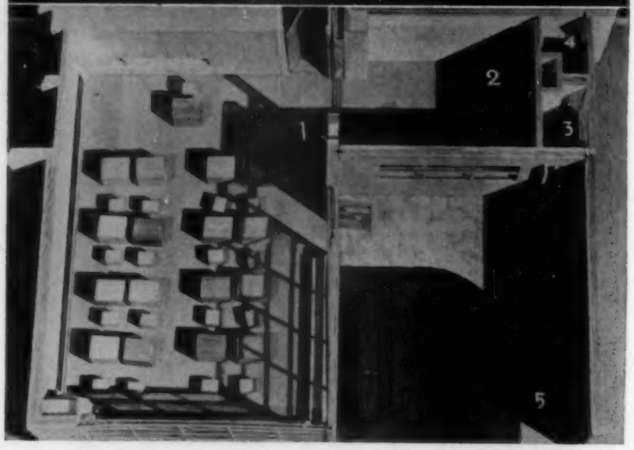
"an intimidating building"

[1] This article is based on a traveling exhibition, *Modern Architecture for the Modern School*, prepared by E. B. Mock for the Museum of Modern Art, New York. Rental fee: three weeks, $40. Recommended for communities which plan post-war school construction.

Photos by Hedrich Blessing and Robert Tague

"a classroom which is quite literally a 'home room'"

Left and above—Each classroom of the Crow Island School, Winnetka, Ill., has its own alcove workshop (separated by sliding doors), its lavatory and drinking fountain, its private garden court. Illustrated are a classroom interior, a workshop alcove, and the photograph of a classroom model. Key to model: 1. classroom, 2. workshop, 3. lavatory, 4. closet, 5. courtyard. The architects were Eliel & Eero Saarinen, Perkins, Wheeler & Will



"folding glass doors can make three walls vanish completely"

Below—An open-air school at Suresnes, France, designed by Beaudouin & Lods. Each classroom is a separate pavilion, connected with the main building by sheltered walks. Accordion doors on three sides can be adjusted to any opening. High ceilings were mandatory under French law

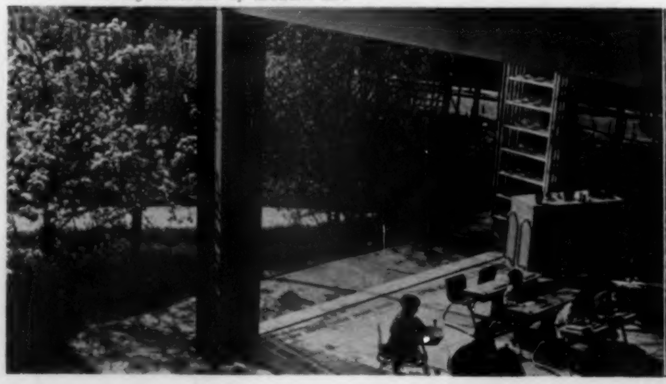
Photos courtesy Museum of Modern Art

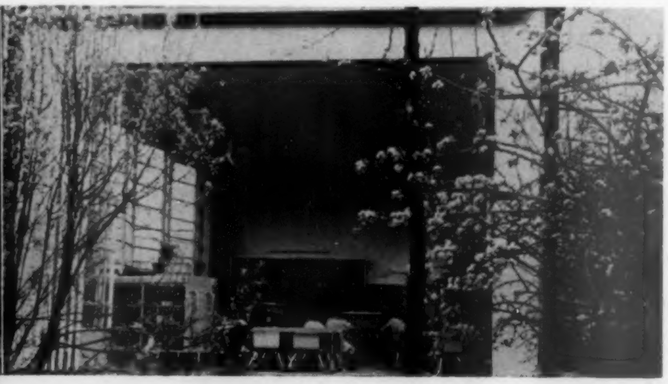
building.[2] There is no formula for the ideal classroom; the solution depends on such variables as method of education, site, climate, and the age and background of the children.

If we once recognize, however, the small child's need for a steady environment where he can feel that he belongs, we can see the advantages of a classroom which is quite literally a "home room," planned for unity and simplicity of experience, and sufficiently spacious and well equipped to take care of most of the activities which otherwise go on in a bewildering array of special rooms. The degree of spaciousness also affects the child's sense of freedom: freedom is inconsistent with overcrowding.

If we grant the importance of encouraging the child's awareness of nature along with his sense of freedom, we can then understand the present tendency towards ground-level classrooms, each with its own

[2] This was the first and decisive step in the design of the Crow Island School, Winnetka, Ill. See accounts by Carleton Washburne and Lawrence B. Perkins in *The American School and University*, 1942, pp. 62–69.





Photos by Spreng, courtesy Museum of Modern Art

"walls . . . entirely made up of low-silled windows"

Each classroom of the Brüderholz Elementary School, Basel, Switzerland, has its own adjacent outdoor classroom. Hermann Baur was the architect

door to the outside and its adjacent outdoor class area. We can also understand why each classroom should be so designed that its enclosed space will seem part of the limitless space outside.

Here we come to a fundamental characteristic of modern architecture: its treatment of space as flowing and continuous from one room to another, and from inside to outside. There are many ways of achieving this effect of openness in the classroom. In favorable climates, sliding or folding glass doors can make one, two, or even three walls vanish completely. (New developments in radiant heating make this practical even in seemingly unfavorable climates.) Sometimes one or more walls will be entirely made up of low-silled windows, some fixed in place, others movable. Whatever the solution, glass and sash form a continuous surface, very different from the isolated, scattered windows of the conventional "Colonial" building.

The unity of inside and outside space is frequently emphasized by the extension of ceiling and transverse walls beyond the glass. These projections shield the glass from rain and are calculated to welcome the low winter sun, yet exclude too much direct sunlight in summer. The fin-like wall projections also act as sound insulators between adjacent classrooms. It would be difficult to find a better illustration of the extent to which the emotional content of modern architecture relies upon the sensitive design of purely practical elements. Good architecture isn't something *added* to a building.

Other more specific factors which affect the child's freedom in the classroom are lighting and furniture. Light from one side, the left, was all right for the old-fashioned schoolroom with its rigid rows of screwed-down desks. Now, however, furniture is light and portable, easily regrouped for different activities. If each child is to have proper light, this new freedom of arrangement demands glass from more than one side.

Finally, the child's well-being requires that the classroom be cheerful, informal, and sympathetic in scale and proportions. Choice of material and color

Photo by Luckhaus

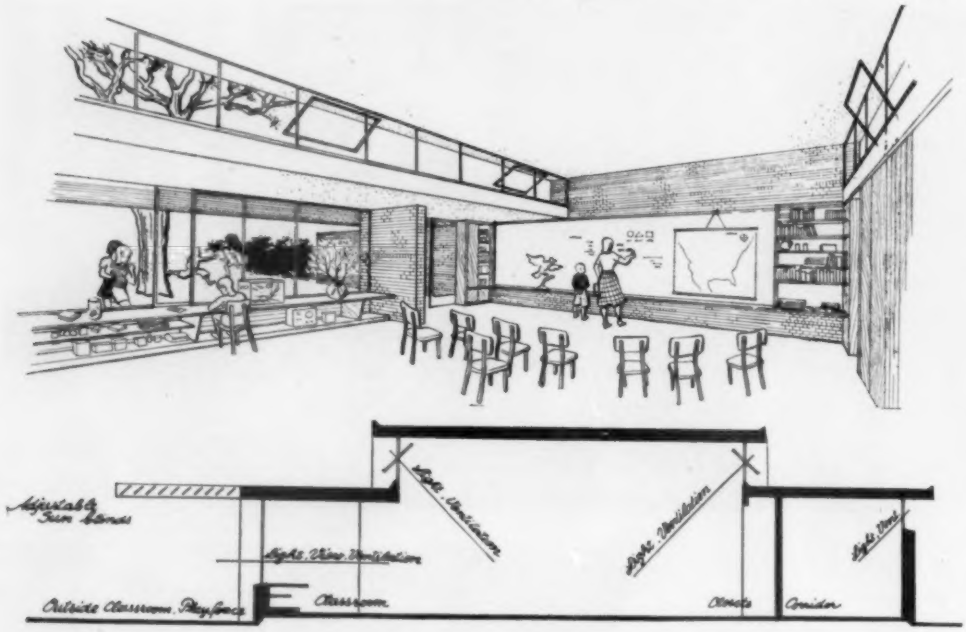
"The unity of inside and outside space . . . emphasized by the extension of ceiling and transverse walls beyond the glass"

Corona School, Los Angeles, designed by Richard J. Neutra. Sliding doors open widely to the outside. The interior is protected from the sun by roof and wall projections, also by roll-up canvas blinds

Photo by Maynard L. Parker

"glass from more than one side"

Primary activity classroom in the Thomas O. Larkin School, Monterey, Calif. Stanton & Mulvin, architects. Extra light comes from high windows above the corridor. Each room has workshop alcove and private terrace



"multi-source light"

A type of fenestration which allows extraordinary flexibility in room width. The high ceilings prescribed in most school building laws are unnecessary if light and air come from two sides. Remember, in any case, that a ceiling need not be uniformly high at every point. A two-level scheme can result in extraordinarily favorable light without sacrifice of an intimate scale

plays an important role here, and the warm color and lively texture of natural materials—wood, brick, stone—will be particularly appropriate. Unpainted, lightly waxed wood makes a beautiful wall finish and provides welcome tacking surface. Perhaps one wall will be painted a bright contrasting color. Applied ornament can be replaced by imaginative display of the pupils' own paintings, fish-tanks and botanical experiments, or by changing exhibitions of objects related to their studies.

Many of the qualities mentioned here have long been accepted for the kindergarten: separate, unpretentious entrance, separate outdoor area, relative self-sufficiency, lots of space, movable furniture, multi-source light, and informal atmosphere. But why should a child at six suddenly be deprived of what he has known and enjoyed at five?

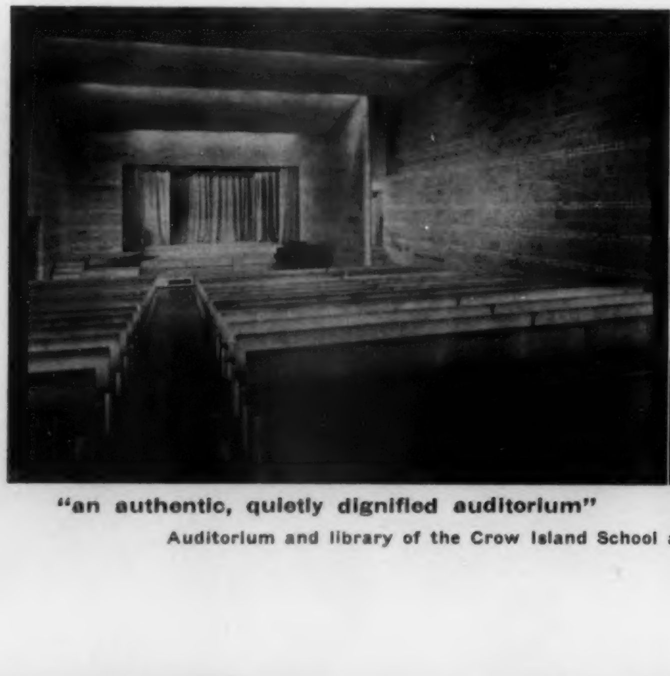
A school is more than a collection of classrooms. There must be at least one room for the large-group activities so important to the development of the child's social adjustment. An auditorium is essential: the most ingenious public-address system is a thoroughly inadequate substitute.

The auditorium-gymnasium combination has rarely been satisfactory for either purpose. Many elementary school principals, even in the north, would gladly exchange it for a roofed play-terrace and an authentic, quietly dignified auditorium, complete with sloping floor, fixed seats, and stage facilities.

Some authorities believe that each classroom should be self-sufficient to the extent of having its own library. Others prefer a central library, used at different times for quiet study, for recreation, for story telling and book clubs, and for the general encouragement of interest in reading. If the library can have its own sheltered terrace, so much the better.

In addition to these common rooms, there will be administrative offices and a staff room where the

Photos by Hedrich Blessing



"an authentic, quietly dignified auditorium"

"a central library"

Auditorium and library of the Crow Island School are planned for the children's use and enjoyment

teachers can meet for conversation and relaxation in congenial, adult surroundings.

The One-Story School

How will all these elements be brought together? Here again there is no single answer; but if the architect is guided primarily by his desire to create a building *for children,* the result will almost certainly be a one-story school, built as close to the ground as possible. This is the easiest way to open each room to the outside, and the easiest way to attain suitable scale.

Many people have the illusion that such schools are impractical. "Fine for California," they will say, "but not for this climate. Too costly to build and heat."

Heating costs may be slightly higher than in a multi-story school, although lowered ceilings can compensate for what is otherwise an increase in exposed surface.

Building costs will, if anything, be lower. Even the solidly built and elaborately detailed Crow Island School in Winnetka, cost no more than an equally fireproof school of the standard type.[3]

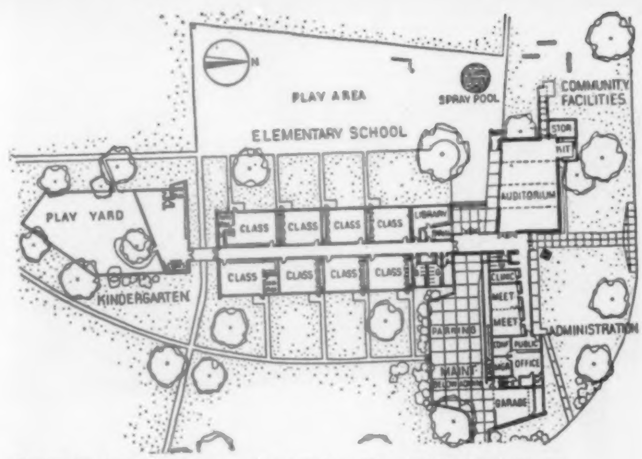
But heavy, fireproof construction, always expensive, becomes unnecessary when each room has its own direct exits. The structure can be wood frame, mixed steel and wood, or prefabricated panel. Light, cheap construction of this kind allows rapid amortization and means that the community will never be left with a not-yet-paid-for but already obsolete school.

Moreover, a single-story building can easily be expanded and loses no space in dangerous stair-halls.[4]

The Building and Its Site

The verb *articulate* means "speak distinctly; connect by, divide with, joints."

Much of the clear beauty of the modern school is due to the bold *articulation* of its parts. Instead of



Photos by John S. Coburn; plan courtesy The Architectural Forum

"Light, cheap construction . . . each element of the building expresses its function through its form"

The combined school and community center at Center Line, Mich., is part of a large government-built housing project for workers in Detroit's war industries. Most of the building is wood frame, finished with unpainted vertical boarding. In vivid contrast are occasional massive brick walls uninterrupted by windows. The wall of the auditorium-gymnasium in the view illustrated is blank because it faces north, but the building opens widely to the south. Saarinen and Swanson were the architects.

being compressed into one massive, non-committal block, each element of the building expresses its function through its form. Even a large school will seem fairly human in scale if its rows of classrooms are arranged in low-spreading wings. The common rooms, naturally quite different in shape, are often used as the focal points of the composition.

A cleanly articulated building easily accommodates itself to an irregular site. The natural character of the land can be retained, even dramatized.

The direct and intimate relationship between the modern school and its surroundings gives special importance to landscape design. Ideally, the grounds are as carefully planned for the children's use and pleasure as the building itself. Each classroom has its

[3] See Lawrence B. Perkins, *The American School and University*, 1942, p. 67.

[4] The case for the one-story school is vividly presented in W. W. Caudill's *Space for Teaching.* College Station, Texas: Texas Engineering Experiment Station, A and M College of Texas. Fourth Series, Vol. 12, No. 9, August 1, 1941. 120 p.

"the natural character of the land can be retained"

The Bruderholz School in Basel is well related to its sloping site. The single rows of classrooms were placed approximately parallel to give each room southern exposure. The three rows are separated by pleasant gardens and connected by a sheltered walk built into the side of the hill. A mechanical effect is avoided by the slight angle of the end row and the gentle curve of the walk. Gymnasium and auditorium are in the large building

Photos courtesy of Museum of Modern Art

private outdoor space, used for anything from open-air classes to rabbit-hutches. Separate play areas, hard surface and lawn, are provided for different age groups and conveniently related to sun shelters and lavatories. The general design is informal and friendly, depending for much of its charm on imaginative use of native vegetation and enthusiastic welcome of such natural features of the site as water, woods, or rocky slopes.

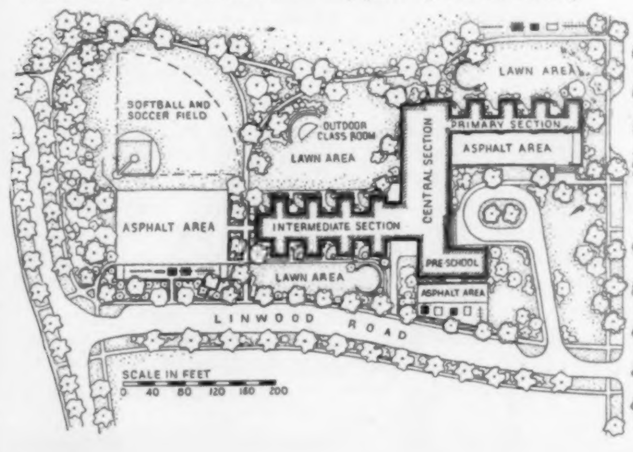
No 18th-Century Mansion

The net result of the new attitude towards school planning may look like nothing you've ever seen before, but it will be a gracious, hospitable, thoroughly human kind of building. Don't condemn it just because it doesn't resemble the 18th-century mansion across the street or the great brick block associated with your own school days.

Forget your prejudices and try to look at the building from the point of view of the children who will use it. That is the ultimate test of a school's success.

The asphalt terrace for primary children, shown below, with sun shelter at its end, is but one of many play areas at the Crow Island School

Plan courtesy The Architectural Forum; photo by Hedrich Blessing



"Separate play areas . . . for different age groups"

A SCHOOL BUILDING PLANNED AROUND THE EDUCATIONAL PROGRAM

By WARREN S. HOLMES and ARTHUR R. SHIGLEY

Warren S. Holmes Co., Architects
Lansing, Mich.

Lincoln Consolidated School
Ypsilanti, Mich.

TO the question, "What will school buildings be like after the war?" there can be only one answer. There will certainly be differences, but whether the result will be better buildings, or simply different buildings, depends on the study given now, during this war period, to the needs of our school systems.

Already post-war planning for improved social, economic, and political relationships is receiving marked attention both here and in England, and some of this enthusiasm for a better world is bound to affect the school—its internal organization and, consequently, the material structure in which it carries on. Moreover, the war, together with the events leading up to it, has demonstrated most convincingly that the manner and content of youth training are of first importance. It seems, therefore, that there is ample basis for predicting changes in school buildings, and that these changes will be prompted and directed fundamentally by the activities demanded of and undertaken in the educational program itself.

The True Aim of Modern School Building Planning

What will make our schools functional? Not merely the trend toward simplified exterior design, although this modern style (in contrast to so-called modernistic design) has demonstrated, and will continue to demonstrate, that maximum beauty in architecture can best be gained through simplicity of line, plain surfaces, and attractive colors, rather than through expensive architectural ornamentation. The complicated cornices, mouldings, and columns that characterize some traditional styles constitute an unnecessary expense, both in the original cost and in cost of maintenance, to be avoided wherever possible.

Nor will our schools necessarily be made more functional by the increasing use of new materials, such as magnesium and plastics, now being tested on our battlefields; although these are certain to be used in many ways. Plastics have already proven excellent for table and desk tops. Conceivably, they will be satisfactory and colorful substitutes for wood, ceramic tile, and marble, in wainscotings, toilet partitions, etc. Stainless steel or extruded aluminum mouldings, spandrels, canopies, and doors are now commonly employed in modern design, and their use will probably be increased. But their use alone will not make possible a structure suitable to a dynamic educational program.

Ideally, the world of tomorrow will be one in which everyone will enjoy freedom from want and from fear; will be trained for the work he is best fitted to do; will have opportunity to learn the wise and profitable use of leisure, and will have tolerance and respect for his fellow men.

Leaving the questions of armies and armaments in more capable hands, we believe that in the march toward that goal, the public school system is the standard bearer. It molds our children's tastes and opinions; it teaches them law and order, teamwork and cooperation; it can and should teach them to live full and useful lives so that the 80% of high-school pupils who make high school their finishing school may not feel underprivileged nor become idle and bored in their leisure hours.

In addition to its work with young people, the public school can be the community center for educational, social, and recreational programs for adults. For these, larger and better-planned school sites are of prime importance. Care in planning the location of the gymnasium, the auditorium, the crafts rooms, etc. makes these also available to adults during the evenings.

New High School Aims Toward These Goals

The new J. W. Sexton High School in Lansing, Mich., occupied February 1, 1943, lays modest claim to having been planned with these aims in view. Perhaps the most significant phase of the entire project is this: two and one-half years were devoted to preliminary planning, while one year and seven months were sufficient for the construction. Too much credit cannot be given the Board of Education and Dr. Sexton, Superintendent of Schools, for their foresightedness in making this liberal time allowance for planning. Because of it, the architect feels that more real progress was realized in this one building than was possible over a decade of planning under the limitations of most school building projects, especially those constructed under the rush program of the Federal Works Agency.

If, after the war, there is another federally sponsored building program, are schools again to be planned in haste and executed in greater haste? If so, what a waste of time, money, and opportunity!

Casual observation of the plans for Lansing's new high school show the building to conform closely to the conventional academic high school; and it is only when the details are studied that the building is found to possess decided differences from the typical high-school structure.

These differences are illustrated by consideration of two types of training, social education and the science studies, to be made more effective and enjoyable by the new facilities in this building. It should be understood that each department was developed with similar care, and that the teachers cooperated every step of the way in interpreting the needs of boys and girls.

Social Education.—Provisions for the social education which is of such great importance in high-school life were carefully considered throughout the building

—in the spacious foyer, in the social room for girls, in the music, homemaking, and science departments, and again in the auditorium, the dramatics suite, and the arts and crafts department. After the physical education needs of the gymnasium were met, the plans were restudied to insure provision for school parties, dances, and the annual school circus. This dictated not only separate entrances for the gymnasium, but also toilets, coat rooms, and storerooms nearby, to avoid the necessity for opening on such occasions the school's locker rooms.

The corridor opposite the cafeteria is expanded to form an open room, 30 by 50 ft., called the recreation area. Here the students may play table tennis or other popular games at the lunch hour.

The classrooms, 22 by 30 ft., are somewhat larger than those we have come to look upon as standard for high schools, allowing more room for pupils to carry out their work assignments, and for seating with tables and chairs.

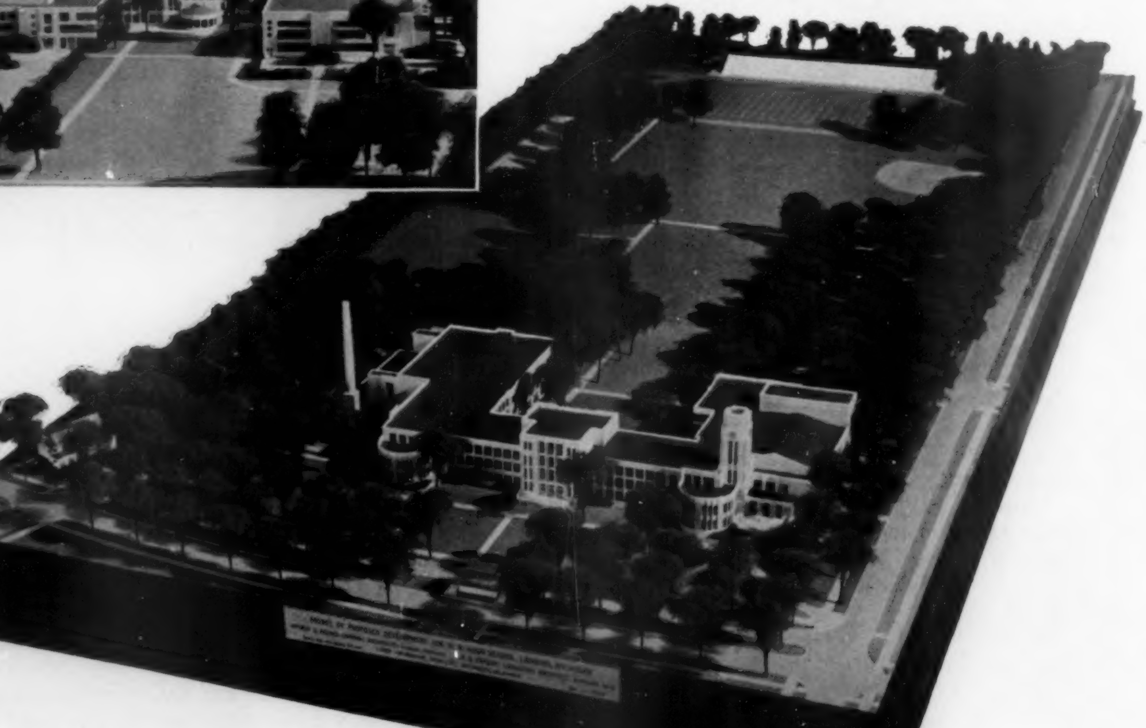
Every classroom in the building has a minimum of 12 lin. ft. of built-in wall cabinets, designed for the particular uses of the subject to be taught. Each classroom in the building was also studied from the needs of student club work, for which regular time is allotted each week, although these activities are considered extracurricular. In general, this extracurricular work required cabinet storage space, under lock and key, for material projects in the process of development. It is interesting to note that practically all these developments, made to add interest and practicality to the work of the student leaving school at the end of the twelfth grade, are equally pertinent to the education and enjoyment of those preparing for college.

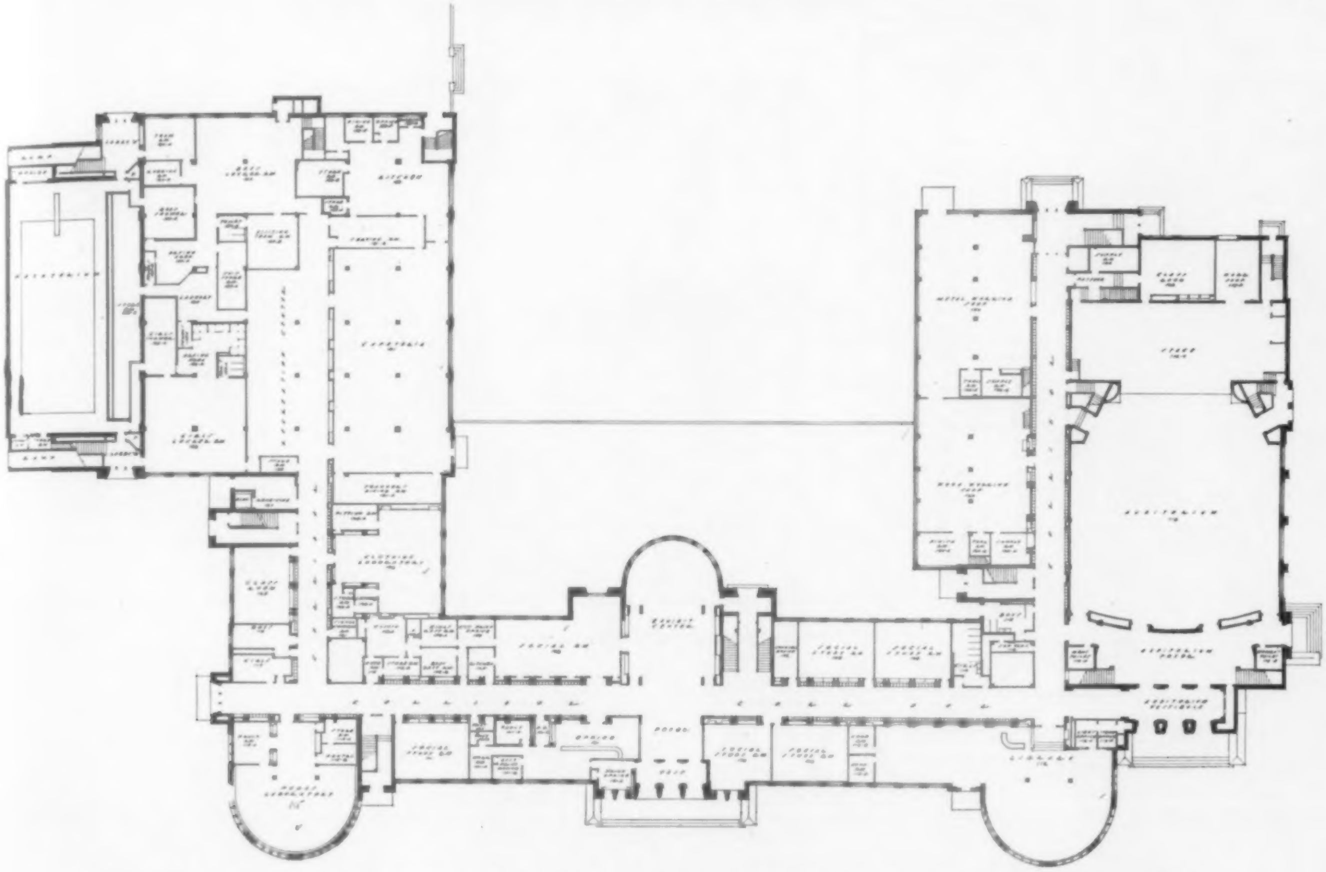
The Science Department.—The faculty felt that many pupils not seeking college entrance avoided courses in science because the college preparatory courses were too technical. The usual provisions for physics, chemistry, and biology, therefore, were expanded with a view to developing science courses that will be more clearly integrated with the practical everyday uses of science.

One of the lecture rooms was made large enough to seat 100 pupils, for popular lectures. In addition to the usual storerooms a science museum is provided where engines, radios, and other machines primarily scientific in operation can be made readily available for work in the laboratories. The workroom off the physics department is developed for student hobby work in science, and a suite of small rooms offers complete photographic accommodations for several pupils. The three upper stories of the tower provide for radio work, and the tower roof has a pedestal for a telescope.

The biology department has a large conservatory fitted with a tile pool about 10 ft. in diameter for different species of Michigan fish. All walls of the biology classroom that are not required for classroom work are built from floor to ceiling into a series of

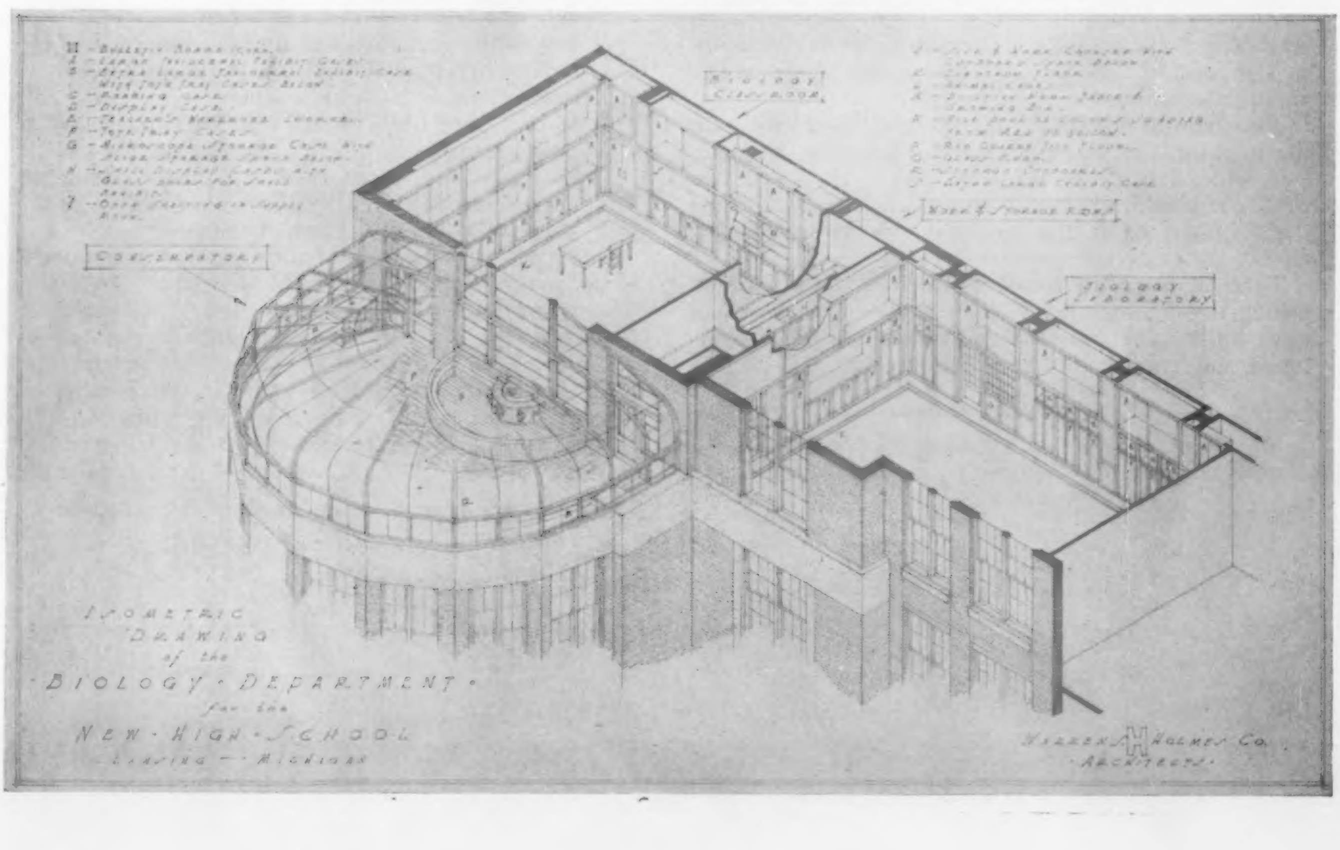
Model for the J. W. Sexton High School, showing the landscape plan (rear view at left, front view below). The school grounds occupy 31 acres. A. D. Taylor, of Cleveland, Ohio, was the landscape architect

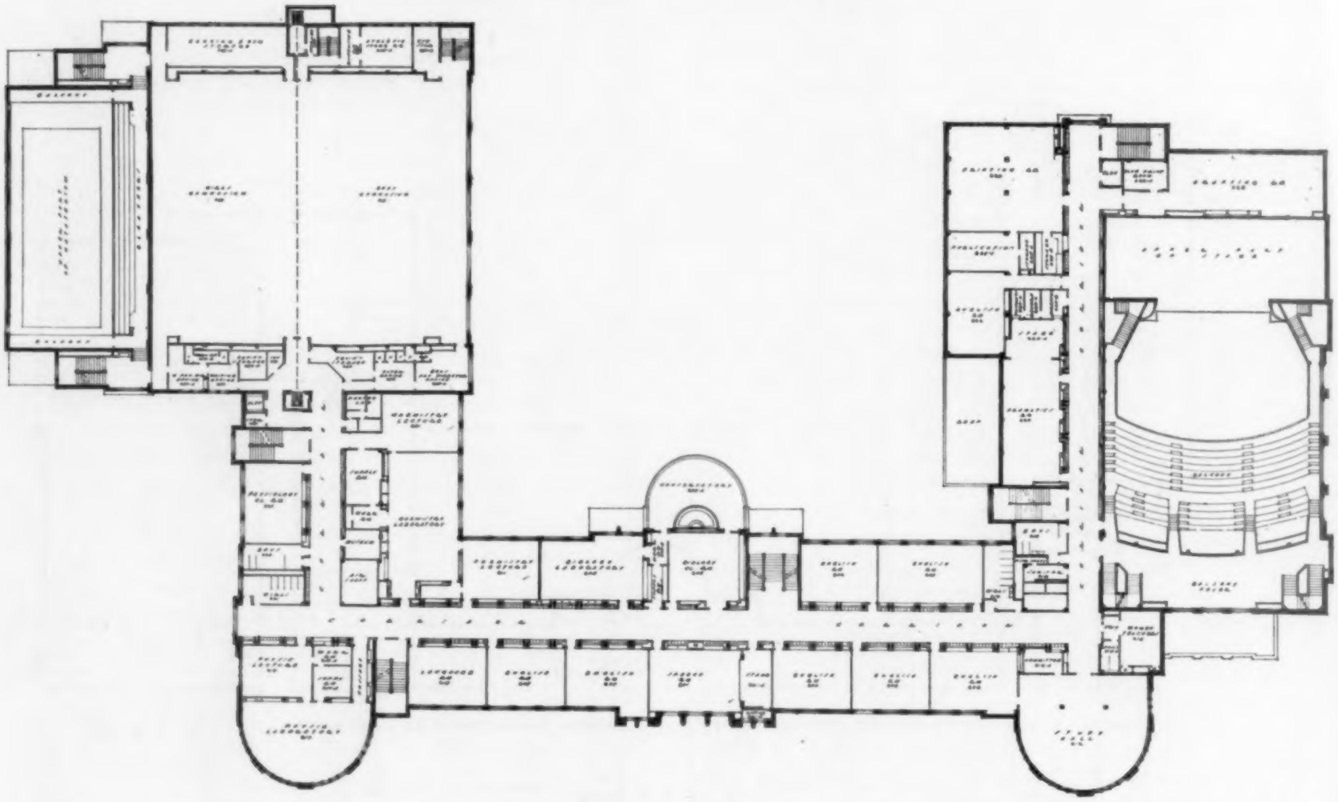




Above—First floor plan. There are two elevators in the building (one in each wing). The auditorium seats 1800

Below—Isometric drawing of the biology department: conservatory, classroom, work and storage rooms, and laboratory. Note the extensive exhibit space in the classrooms and the tile pool for fish in the conservatory





Second floor plan. The gymnasiums, separated by electrically operated doors, can be combined to seat 2500 persons for inter-city basketball games

exhibit cases, with glass fronts, for storage of the school's valuable taxidermy collection.

The electric lighting for each exhibit case is controlled from a switchboard back of the teacher's desk for convenience in instruction. If, for example, the class is studying simple cell life, the instructor switches on the light in the case illustrating this phase of the mounted exhibits.

Two exhibit cases for large groups, one opening on the corridor and the other in the classroom, measure 8 ft. wide, 3 ft. deep, and 6 ft. high. A suite of two workrooms with an outside entrance and unit ventilation is provided in the basement for preparing and mounting taxidermy specimens.

These unusual provisions for taxidermy are justified principally because the biology classes of this school have built up a collection of great instructional interest and valued at a considerable sum.

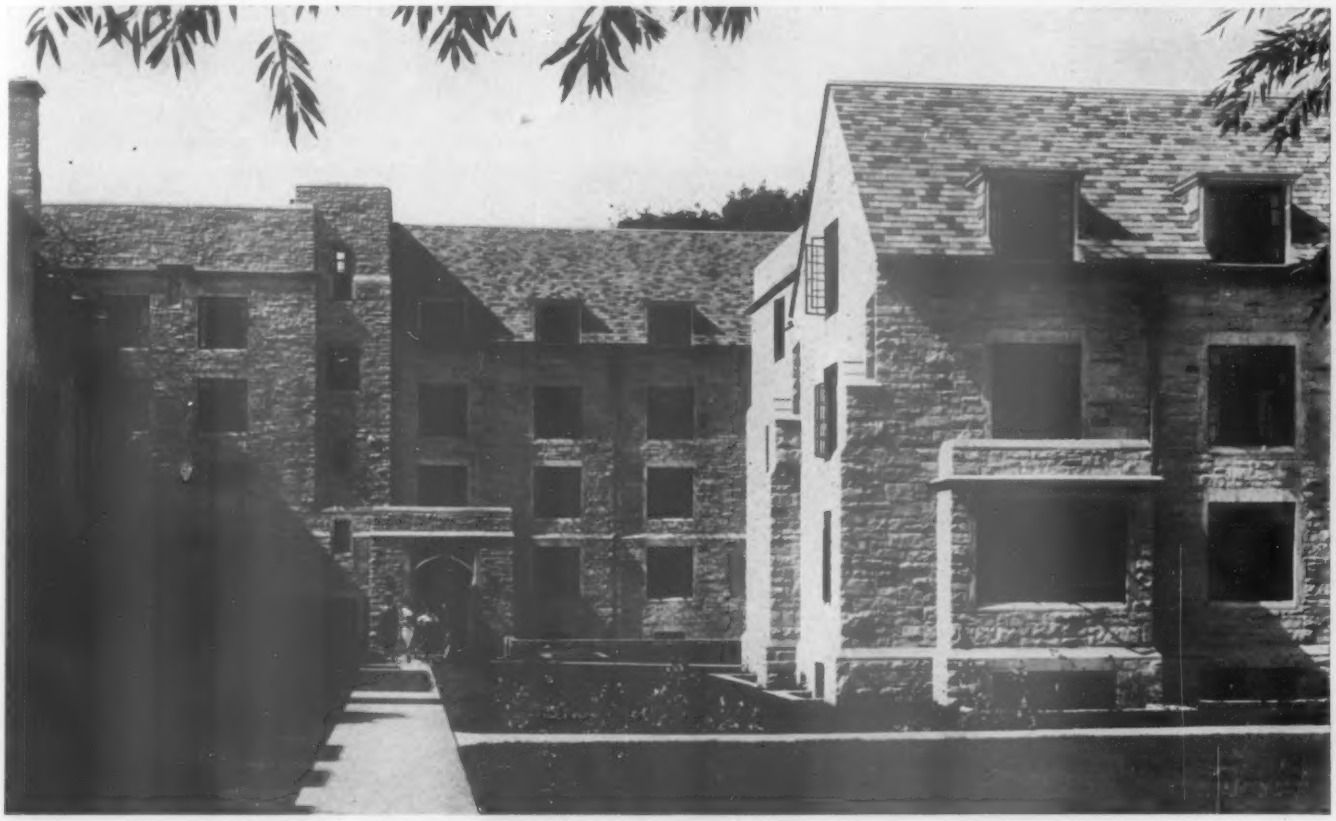
A Plan of Action

The successful school buildings of the future will depend on the thoroughness with which each school does its spadework now. We offer the following suggestions:

1. Make a survey of the needs of your school and your community.
2. Whether your goal is a whole new school plant, a new music and shop building, or merely the better use of existing facilities, begin now to solicit suggestions from your teachers.
3. If there are obsolete laws or building codes in your state, begin now to educate the parents to do something about them. Educators can get measures on the ballots, but they cast a comparatively small number of votes.

Our present spending of billions for armaments alone, makes ridiculous the old argument that good schools are too expensive. "It is time," says Homer Anderson, the aggressive and practical president of the American Association of School Administrators, "that education stopped apologizing. It should be seen once and for all, and seen by the public as well as by the school people themselves, as an essential service."

TILE-TEX...FLOORS FOR THE MODERN SCHOOL



Willard Hall Dormitory for Women—Northwestern University, Evanston, Ill.

Tile-Tex is an asbestos-asphalt composition tile flooring, which has been used for seventeen years in schools throughout the United States. Tile-Tex floors give uniformly good service, represent on the average a low investment cost per square foot, and are maintained simply and economically. They represent what we honestly believe to be the greatest value in floors for schools that can be purchased today.

Tile-Tex is designed and manufactured to meet the demand for a low cost flooring, installed in tile size units, that will withstand heavy foot traffic under exacting conditions over a long period of years. Prominent school architects throughout the nation specify Tile-Tex consistently and know from experience that the Company manufacturing it can be relied upon to stand behind the material and improve it year after year.

On the following pages are photographs showing Tile-Tex in use in practically every type of area found in schools today. Tile-Tex is often specified because of this versatility and adaptability to a wide variety of uses. Hundreds of Tile-Tex installations in schools throughout the country are mute testimony to the quality of the product and the knowledge and skill of the Tile-Tex contractors who install it.

Tile-Tex is available in three thicknesses—1/8", 3/16", and 1/4". It is made in a wide variety of sizes, which include the following: 3x3, 3x6, 4x4, 4½x4½, 4x12, 6x6, 6x12, 6x18, 9x9, 9x18, 9x27, 12x12, 12x24, 18x18, 18x24, and 6" Hexagon.

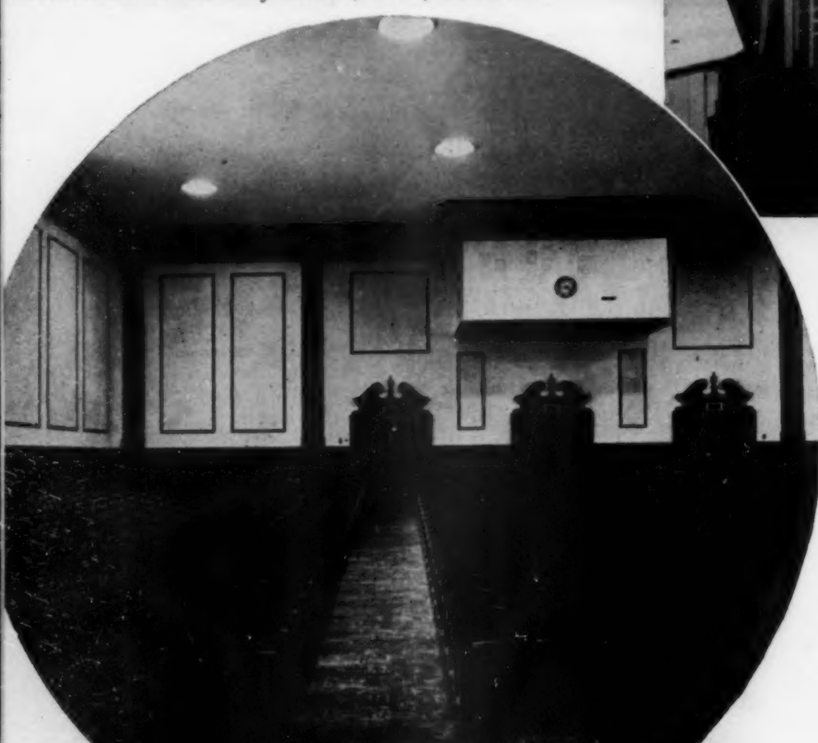
Tile-Tex welcomes constructive criticism from all school officials and is constantly ready to help in the solution of any problems connected with schoolhouse floors.

Top photo below—For special areas, such as a domestic science room, Tile-Tex is both practical and attractive. Here ease of cleaning, closely textured surface, and resistance to food abuse are met by the use of Greaseproof Tile-Tex. Installation shown is the domestic science room in the Wappingers Falls, N. Y., Central School.

Bottom photo below—For laboratories, Tile-Tex is acid and alkali resistant, comfortable to stand and walk on, and easy to clean. Tile-Tex was selected for the Guggenheim Dental Clinic laboratory, New York City, because of these qualities.

The Tile-Tex floor shown above is in the Southampton, L. I., N. Y., Grade School. It is long-wearing, non-distracting to the pupil, easy to keep clean, and suitable for either fixed or movable seating equipment.

For auditoriums, Tile-Tex is flexible in design, adapted for ramps and inclines, easy to clean, and durable. Below you see Tile-Tex in service in the auditorium of the Bay Shore, L. I., School.

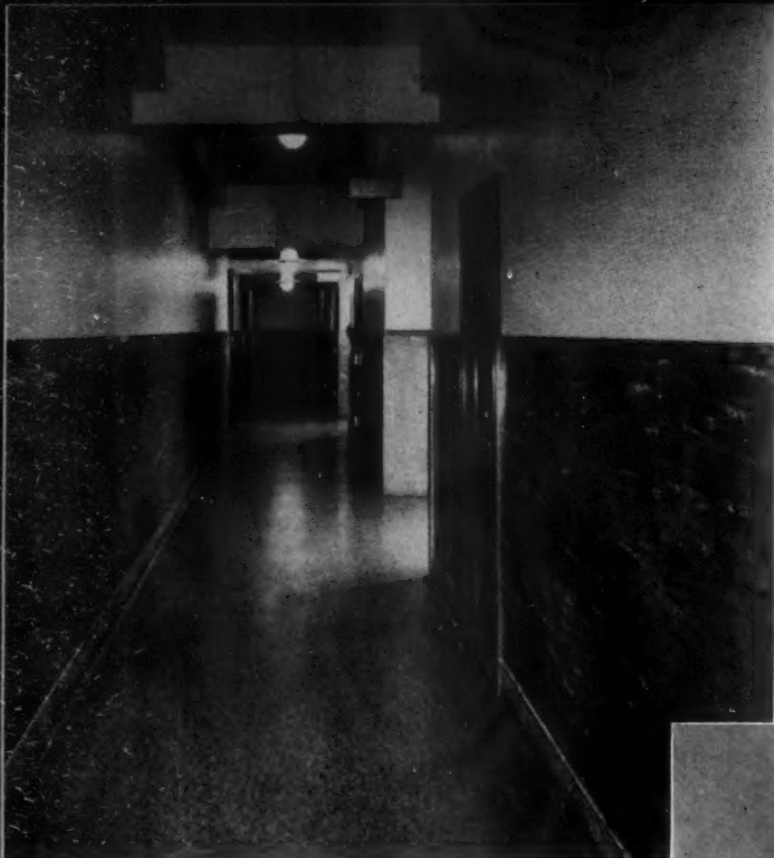


Right—School corridor areas are a "natural" for Tile-Tex floors. The corridor floor shown here, in the Southampton, L. I., Grade School, is safe to walk on, attractive, easy to maintain, quiet, durable, and economical.

Below—For this social room area, in Northwestern University's new Willard Hall, Tile-Tex was found to be the perfect answer for an attractive, serviceable floor, so necessary for this type of use. Note the striking modern design.

Above—Kindergarten, Mattituck, L. I., N. Y., Grade School. Here is a Tile-Tex floor that is safe for children to play on, quiet, attractive, sanitary, and easy to clean.

Right—Tile-Tex was the answer to the floor problem in the gymnasium at St. Vincent's School, Buffalo, New York. Unaffected by moisture, non-slip when unwaxed, and sufficiently resilient, Tile-Tex makes an excellent gymnasium floor.



TILE-TEX WALLS ARE IDEAL FOR SCHOOL WAINSCOTING

Tile-Tex Wall Tile is a new and adaptable wall covering material, well suited for school purposes. It is a flexible, individual tile manufactured from asbestos fibre, mineral coloring pigment, and special binders. Tile-Tex Wall Tile can be applied over existing plaster walls in present buildings, or over smooth plaster backing or smooth-surface wallboard in new construction. Its cost is considerably less than that of conventional ceramic tile.

Above you see Tile-Tex used as an attractive corridor wainscot. Its use here obviates the need of painting over that area covered by the wainscot. Over a period of years, this means a considerable saving as against paint or any other type of surface which must be renewed. Fingerprints, so common on painted walls, will not show up on appropriate, selected colors of Tile-Tex. Any dirt marks or stains can be easily removed with a damp rag and Kitchen Klenzer.

Right—In cafeterias, Tile-Tex has proved itself an excellent wainscot material. In the Wappinger Falls, N. Y., Central School shown here, the wainscot is plain color Tile-Tex Wall Tile. Incidentally, the floor here is also Tile-Tex, laid in colors to harmonize with the wall tiling.

Other areas where this new, unique wall covering can be used are toilets, rest rooms, and laboratories.

Colors—Tile-Tex Wall Tile is available in a wide range of colors, from light pastel shades to medium and darker hues. Over 32 colors are included in the Aristocrat color group. Send for the booklet, "Decorative Walls by Tile-Tex," which includes complete color charts.

Sizes—Fourteen sizes, from small to large, make possible wall treatments heretofore not obtainable with other types of material. Sizes include the following: 3x6, 4x4, 4½x4½, 4x12, 6x6, 6x12, 6x18, 9x9, 9x18, 9x27, 12x12, 12x24, 18x18, and 18x24.

WALLS TILE-TEX FLOORS

THE TILE-TEX COMPANY

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RU-BER-OID Built-up Roofs are recommended for flat surfaces or roofs with a slight pitch. There are four popular types of RU-BER-OID Built-up Roofing: Asbestos felt and asphalt, coal tar pitch and tarred felt, asphalt felt and asphalt, and the combination roof consisting of asphalt felt, asphalt-saturated asbestos felt and roofing asphalt. You can choose the proper type to meet climatic conditions, anticipated life of building—fire hazards, construction of roof decks, etc. A complete catalog will be mailed upon request.

Ruberoid's pipe coverings, sheets and blocks, will take care of a full range of temperatures from 350° to 2100° F. Lead-

85% Magnesia Pipe Covering

ers are 85% Magnesia, "48" Copr-Fibre, Woolfelt, Asbestos laminated and cellular coverings and blocks, Asbestos papers for furnace pipe and air conditioning work, Insulating Cements, etc. *A complete Insulation Guide will be forwarded upon request.*

INSULATING MATERIALS

The Ruberoid line of insulation products is complete—products of proved merit, high efficiency and to meet every economic need. Included is Rock Wool, one of the finest insulating materials for schools. It is available in three forms—loose or bulk for packing, granulated for pouring, and in pre-formed bats for use between joists, rafters and studding.

ASBESTOS-CEMENT SHINGLES

For pitched roofs, where beauty is a factor, where a roof must be weatherproof, fireproof, rotproof and time-defying—Eternit Asbestos-Cement Shingles win favor with the architect. These shingles, Ruberoid-made, come in various weights, designs and colors.

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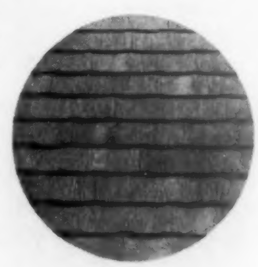
One of the most pleasing yet economical designs is the Mt. Vernon American Method shingle. This shingle has the beauty of weathered cypress with irregular butt lines. You get the effect of the charming early American "thatch" yet this shingle is economical to buy and apply. Underwriter's Label Class "B."



ASPHALT SHINGLES

Where a low-cost, yet durable, fire-resisting roof is required, Ruberoid offers Asphalt Shingles in various weights, colors and attractive designs. Full descriptive literature upon request.

STONEWALL BOARD

A smooth, rigid, fireproof board made from asbestos and cement. Used extensively for partitions, interior wall and ceiling linings—for air conditioning ducts instead of metal—and for general fireproofing purposes. Saws readily, nails easily. Available in sheets 4' x 8' and in two thicknesses, 3/16" and 1/4".

For Complete information write to School Engineering Department, The RUBEROID Co., 500 Fifth Avenue, New York, N. Y.

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Tile
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- Non-slip Safety

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- Moultread Stair Tread and Nosing
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- Permagloss Self-polishing Wax
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Thos. Moulding and other approved flooring contractors contract to install floors anywhere in the United States and nearby countries. Write for samples and complete technical information on Moultile and the company's other products, listed above.

THOS. MOULDING

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Flexible Reinforced
MASTER ASPHALT TILE

Durability, the most important requirement for school floors, is an outstanding characteristic of Moultile Asphalt Tile. Millions of scuffing, scraping feet will cause no perceptible wear . . . will not affect color and texture which are uniform throughout. Moultile, therefore, requires no expensive periodic refinishing.

Moultile is quiet underfoot and has a pleasant resilience and elasticity. Available in approximately 50 plain and marbleized colors and twelve sizes, Moultile can be installed in a practically unlimited variety of patterns. Colors are clear and do not fade.

Moultile is ideal for classrooms, corridors, and lobbies. In gymnasiums it yields a secure footing which does not tire contestants or cause floor burns and may quickly be waxed for dancing.

Moultile and the asphalt cement in which it is laid are impervious to the alkali and dampness always present in cement resting on the ground, which destroy other types of flooring. Moultile bonds permanently, does not buckle or loosen and will not rot or decompose. It solves the problem of flooring over cement resting on the ground.

St. Ann's High School, Chicago, Ill.
Unusual design with Moultile inserts and lettering in kindergarten room

SPECIAL FLOORS FOR SPECIAL AREAS

Thos. Moulding Greaseproof Tile resists the grease and oils that discolor and soften other floor coverings. It is ideal for domestic science rooms, kitchens, cafeterias and machine shops.

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Thos. Moulding Safety Tile has non-slip chips incorporated during the manufacturing process. It is similar in appearance to terrazzo and positively eliminates the slip hazard, even when the floor is wet. It should be used on ramps, stairways, vestibules, etc.

Thos. Moulding Moultread is a combined stair tread and nosing of exceptional strength, especially useful for repairing worn stairs. Glueing only is required . . . no drilling or anchoring. Moultread can be supplied in the Non-slip type for added protection against slipping.

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Thos. Moulding Flexible Asphalt Base is an economical, sanitary and highly decorative base for use with asphalt tile, linoleum, linoleum tile, rubber, cork, etc. Available as Butt Type or On-top Type Cove Base or as Straight Base.

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All types of Thos. Moulding tile floors can be applied over old cement or wood floors in almost any condition. Special materials have been developed by Thos. Moulding to smooth and strengthen sub-floors that are cupped, cracked, uneven or springy.

Thos. Moulding specializes in the repair of magnesite and mastic floors.

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***RUBBER CORRUGATED EAVE CLOSURE STRIPS** . . . Corrugated roofing strip material.

***RUBBER TILE FLOORING** . . . Colorful flooring of tongue and grooved type.

***CORK-RUBBER FLOORING** . . . Used for gymnasiums, corridors, libraries and offices.

** (Not in production for the duration)*

PARA-PLASTIC HOT-POURED RUBBER-LIKE WATERPROOF SEALING COMPOUND

Widely recognized and formerly known as Para Plastic Hot-Poured Rubber Sealing Compound, "the effective waterproof seal"—Servicised has recently developed a PARA-PLASTIC SUBSTITUTE after many months of experimental research.

PARA-PLASTIC SUBSTITUTE is composed of non-critical materials (containing no rubber) and conforms fully with top Federal Specifications SS-F-336 covering a hot-poured sealing compound.

PARA-PLASTIC bonds firmly with concrete, steel or wood, and performs as a joint or crevice sealer against infiltration of water. This material is not affected by ordinary extremes of summer or winter weather.

Specify PARA-PLASTIC Hot-Poured Rubber-Like Sealing Compound as your waterproof protection in general construction.

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PREMOULDED ASPHALT EXPANSION JOINT . . . This joint is considered the standard joint and is generally used when special conditions do not require the use of other types.

PREMOULDED FIBER EXPANSION JOINT . . . An excellent product for extrusion control. The non-oozing feature makes this joint appropriate for use in monolithic construction, base pavement, concrete slabs, etc.

PREMOULDED CORK EXPANSION JOINT . . . A joint that is ideal for construction work where a resilient, non-oozing type of expansion is required. We recommend this joint for the construction of dams, swimming pools, reservoirs, bridges and highways.

***PREMOULDED CORK-RUBBER EXPANSION JOINT** . . . Where increased resiliency of product is desired for special work, we suggest Servicised Cork-Rubber Expansion Joint.

PREMOULDED SELF-EXPANDING CORK EXPANSION JOINT . . . An efficient joint especially designed for concrete slabs that contract beyond their original set.

***PREMOULDED SPONGE - RUBBER EXPANSION JOINT** . . . This was the first type of resilient joint designed. Its uses are very similar to those of Cork-Rubber and Cork, namely on bridges, retaining walls, dams, etc.

SEWER PIPE JOINTING COMPOUNDS

HOT-POURED COMPOUND . . . A composition of tough flexible petroleum asphalt for vitrified clay pipe.

TUFFLEX . . . A cold premixed plastic trowelling compound that arrives on the job for immediate use.

PREMOULDED SEWER PIPE BELT . . . A belt shaped material that is calked between the bell and spigot of sewer pipes.

Our continual research and experiments are producing commodities to meet the demands of the most exacting nature. The Engineers in our laboratory will assist you in any construction problem involving the type of products we manufacture.

We grant you this service and gladly invite your inquiry.

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General Offices

Waterbury, Connecticut

ANACONDA THROUGH-WALL FLASHING

Why Through-Wall Flashing?

—Because modern skeleton frame construction requires spandrel waterproofing. Quoting from the Kidder-Parker "Architects' and Builders' Handbook":

"Because of the gradual reduction of thickness of exterior walls and the use of hollow-tile construction, wind-driven rain and moisture enter the structure through the face brick and mortar joints. The result is the formation of water pockets, which eventually make contact with ceiling and wall plaster."

Why ANACONDA Through-Wall Flashing?

Anaconda Through-Wall Flashing installed under copings and at the bases of parapet walls or counter flashing level, also in side walls at frequent intervals (preferably at every floor and at all openings such as door and window-heads and sills), intercepts all rain water that seeps in and diverts it to the roof or outside face of the wall as desired, making the building walls completely rainproof.

School Architects and School Building Contractors

who have used Anaconda Through-Wall Flashing are enthusiastic about its many advantages:

1. The 7/32"-high zig-zag corrugations provide complete bond in the mortar in all lateral directions.
2. The integral dam throughout its length is the full height of the corrugations.
3. The dam and corrugations combine to give complete assurance of drainage in the desired direction. **This flashing will drain itself dry on a level bed,** reducing to a minimum the possibility of wet walls and heaving by frost.
4. **The flat selvage permits neat, sharp bends for counter-flashing or locking to adjacent sheet metal without distorting the flashing or inhibiting free drainage.**
5. Anaconda Through-Wall Flashing is easily locked endwise, even with the selvage preformed, merely by nesting one or two corrugations. This makes the joint watertight.
6. As shown in the illustration at lower left, the design of the dam is such, with its tongue near the top of the mortar joint, that this edge of the flashing can be placed within ¼-inch of the face of the wall and still provide sufficient bed for the pointing of the mortar joint so that it will not chip out. Thus, Anaconda Flashing protects more of the wet portion of the wall than is possible with types having turned-back dams.

Anaconda Through-Wall Flashing is efficient, positive and durable, yet relatively inexpensive. It is readily adaptable to practically every masonry condition.

The principal feature of its design is the series of **zig-zag** ridges 7/32" high intersected at one end by a 7/32" longitudinal ridge which acts as a dam, causing any accumulation of water to flow to the opposite face of the wall.

The zig-zag ridges prevent lateral movement in any direction. The possibility of vertical movement may be disregarded, as a properly designed masonry wall has its mass and weight so proportioned in relation to wind and other forces that uplift does not occur under any normal condition except as a result of heaving by frost which, if of sufficient force to cause vertical movement of the wall or coping, would be sufficient to break the bond between masonry, mortar and flashing of any design. Actually, **Anaconda Through-Wall Flashing assures minimum risk of heaving by frost as it is so designed that it will drain itself dry on a level bed.**

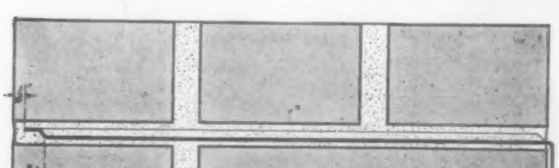
"Anaconda Flashing is made in a variety of types and sizes, of 16-ounce Anaconda copper. All standard types for 8" and 12" walls come in 5-foot and 8-foot lengths. Wider flashings with continuous corrugations are furnished for thicker walls and for spandrel waterproofing."

Because it can be bent and cut to fit on the job, Anaconda Through-Wall Flashing can be installed easily and quickly, with a minimum of delay to bricklayers and masons. Tight end joints can be made by overlapping one or two corrugations.

Detailed information is contained in Anaconda Publication C-28-s. Copies available upon request.

One-Piece Inside Corner Flashing

One-Piece Inside and Outside Corner Flashings are now available for both 8" and 12" walls. They are so designed that the corrugations will interlock with those of adjoining straight flashings. Installation is simple: A corner is flashed by first assembling the three flashing pieces, then marking their exact position on the masonry. The pieces are then removed and a thin bed of mortar spread on the wall, after which the straight flashings are laid and imbedded in the mortar. The corner flashing is put on last, lapping the straight flashings by two corrugations.



Cross-Section of Through-Wall Flashing Detail

EVERDUR METAL HOT WATER STORAGE TANKS

Everdur Metal, The American Brass Company's copper-silicon alloy, has become the most widely used material for non-rust hot water storage tanks, because it combines the desirable qualities of copper and steel. Everdur is immune to rust and highly resistant to many corroding agents; it possesses the tensile strength of mild steel and can be readily fabricated by welding.

Hot water storage heaters made of Everdur eliminate a source of rust-tainted hot water and reduce maintenance costs to a minimum.

The corrosiveness of hot water and the constant pressure in storage units render rustable tanks decidedly uneconomical in countless instances; as the factor of safety decreases in proportion to the extent corrosion weakens the shell. Because rust cannot weaken the shell of an Everdur heater, the factor of safety remains constant. Everdur has made it possible to build, at reasonable cost, dependable heater shells which meet every specification and the most rigid tests.

In the past twelve years Everdur tanks have been installed in a large number of schools and universities, as well as hospitals, laundries, textile mills and other institutions and industries where a constant supply of clean, hot water is not only a convenience but a necessity. When an Everdur hot water tank is connected with brass pipe or copper tube carrying lines, the combination provides the most efficient and economical hot water supply system that can be installed. Publication E-10 describes the advantages of Everdur storage water heaters.

THE JENNISON-WRIGHT CORPORATION

Toledo, Ohio

BRANCHES IN ALL LARGE CITIES

Kreolite Separate Wood Block Floors serve in the school and educational institution no less than in the factory and work shop where today their use is so general as to reveal Kreolite as the national choice for heavy-duty service.

Especially is Kreolite specified for all departments where mechanical operations are carried on. Tools are not damaged when they are dropped, for the Kreolite floor is resilient. The floor is not damaged because wear and accident leave no appreciable impression upon the tough end grain surface of the specially treated selected wood blocks.

Among the scores of leading educational institutions now enjoying the economy and benefit of Kreolite Wood Block Floors are: East Tech. High School, Cleveland, Ohio; Jefferson High School, Los Angeles, Calif.; Lindbloom High School, Chicago, Ill.; University of Michigan, Ann Arbor, Mich.; Purdue University, Lafayette, Ind.; Technical High School, Indianapolis, Ind.; University of Illinois, Urbana, Ill.; University of Wisconsin, Madison, Wisc.; Yale University, New Haven, Conn., etc., etc., etc.

Write for complete information

KREOLITE

WOOD BLOCK FLOORING

Kreolite Wood Block Floors Used in Over 200 Schools!

Kreolite Flexible Strip End Grain Wood Block Floor in the Gymnasium of the New York State Vocational Institution, West Coxsackie, New York

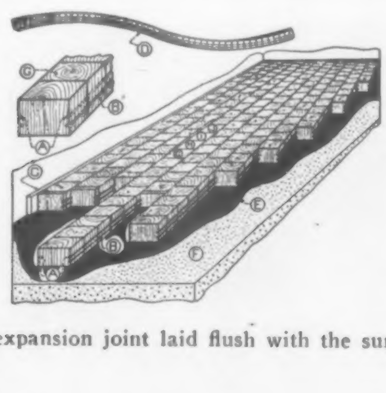
One of the many Kreolite gymnasium floors giving maximum of resilience, safety, appearance, wear, non-slipping, and all around satisfaction as to its ability to successfully withstand gymnasium play of all kinds.

The value of Kreolite Flexible Strip End Grain Wood Block Flooring is recognized instantly by the modern architect of schools and public buildings. They cannot become loose in the floor. The durability is practically limitless as the strips are laid with the tough end-grain of the individual blocks uppermost. The light natural color and beauty of the wood are retained, although the blocks are treated with a transparent, waterproof preservative.

Complete Information Sent on Request

(a)—Metal wire truss binding the individual blocks into a compact, solid monolithic-like end-grain plank or strip.

(b)—Metal spline binding the individual strips together.



(c)—Cork expansion joint laid flush with the surface of the floor.

(d)—Flexibility—can be laid over wood sub-floor, in mill type buildings.

(e)—Waterproof membrane between concrete and strips.

(f)—Smooth finish concrete foundation.

(g)—Surface sanded smooth.

(h)—Manufactured from properly dried yellow pine or fir.

(i)—Treated with a transparent, odorless, waterproofing preservative so that the natural light color of the wood is maintained. The surface of the floor may be waxed and highly polished if desired, presenting a most pleasing and beautiful design.

(j)—Laid with the tough end-grain up. End-grain blocks run full depth of strips, from top to bottom, each block being anchored to the base, in a bed of mastic.

Kreolite Wood Block Floors Used in Over 200 Schools!

J-M ASPHALT TILE FLOORING

This dining hall floor illustrates one of many attractive patterns possible with J-M Asphalt Tile. And this versatile flooring is as serviceable as it is beautiful!

Highly wear-resistant, easy to maintain, yet resilient and comfortable to walk on, J-M Asphalt Tile is an excellent flooring for the heavy traffic in school corridors

As a decorative resilient flooring of low first cost, exceptional durability and extremely low maintenance, Johns-Manville Asphalt Tile has found widespread acceptance with school and university officials. Many millions of square feet are in use in classrooms, corridors, gymnasiums and other locations where economy and serviceability are important.

The raw materials used in J-M Asphalt Tile are mined, processed and refined under standards that are rigidly controlled to insure a uniformly high-quality product. Selected asbestos fibres from Johns-Manville's own asbestos mines are the largest single ingredient. These, with the moisture resistant asphalt and inert mineral fillers which are added to increase density, are combined to form a floor covering that cannot rot, is highly resistant to moisture, resilient, comfortable to walk on, sanitary, and because of its high resistance to abrasion, gives many years of service with little attention for maintenance.

J-M Asphalt Tile is available in an extensive selection of both plain and marbleized colors and a wide range of sizes, permitting literally hundreds of interesting floor patterns. Made in precision-cut units, the tiles are quickly and economically laid over any suitable sub-floor. All units are now pre-waxed at the factory, providing a finished floor which requires no waxing or polishing before it is ready for service and protecting the floor from possible rough usage in connection with other construction activities.

For further information, see Sweet's Architectural catalog or write for full-color Brochure FL-20A.

J-M BONDED ASBESTOS BUILT-UP ROOFS

As pioneers in the roofing field and manufacturers of a complete line of built-up roofing products, Johns-Manville recommends the Smooth-Surfaced Asbestos Built-Up Roof as the most satisfactory for school service from the double standpoint of economy and fire-protection.

The asbestos felt as used in the J-M Smooth-Surfaced Roof does not support combustion and therefore provides a marked superiority in fire-resistance over the ordinary roofing felt. The protection offered by the smooth-surfaced asbestos roof against roof-communicated fires has been demonstrated many times in actual service.

Furthermore, since asbestos has the durability of stone, long exposure to sun, rain and weather have little effect on these roofs. Rot-proof, they need no periodic coating with slag or gravel. Maintenance costs are correspondingly low. Many Johns-Manville Smooth-Surfaced Asbestos Roofs that were applied 25 and 30 years ago are still giving service with little or no upkeep, testifying to the outstanding economy of this type of built-up roof.

Further details and specifications furnished on request.

Bonded for 10 years—still going strong after 25 years of service! That's the record of the J-M Asbestos Built-Up Roof on the Poly Prep Country Day School, Brooklyn, N. Y. It is typical of the service provided by these better built-up roofs

CONGOLEUM-NAIRN INC.

General Office: Kearny, New Jersey

Nairn Linoleum . . . Ideal for Floors and Walls In All School Areas

Eye appeal, longer wear, resilience, cleanliness and easy maintenance are achieved by the modern use of Nairn linoleum for school floors and walls. Nairn linoleum is inexpensive to install, and the smooth, sanitary, easily cleaned surface needs no costly refinishing through years of constant use.

For walls, Nairn wall linoleum provides a handsome, washable, **permanent** finish. It is fade-proof, crack-proof, and water-proof.

Nairn linoleum floors and walls help create that pleasant, restful atmosphere so ideal for schools. The superior beauty and durability, together with the germicidal and insulating qualities of Nairn linoleum dictate its use in school remodeling or construction.

For catalogs, samples and free assistance in your wall or floor problems, write Congoleum-Nairn Inc., at Kearny, N. J.

● **Attractive, unusual and interesting effects can be secured with Nairn linoleum, such as in the music room shown above**

NAIRN

Reg. U. S. Pat. Off.

LINOLEUM FLOORS AND WALLS

● **This attractive Nairn linoleum floor adds beauty and is easy to keep spotlessly clean**

● **Nairn linoleum for floors and walls is perfect for school corridors. Muffling the sound of footsteps it gives years of service under heavy traffic**

● **The resilient Nairn linoleum floor in this classroom makes it more comfortable and quiet for study and recitation**

WOOD CONVERSION COMPANY

Manufacturers of

NU-WOOD Interior Finish . . . and BALSAM-WOOL Sealed Insulation

St. Paul, Minnesota

NU-WOOD KOLOR-FAST—High Sound Absorption

NU-WOOD STA-LITE—High Light Reflection

NU-WOOD Insulating Interior Finish — KOLOR-FAST and STA-LITE

Nu-wood (Kolor-Fast and Sta-Lite) Interior Finish is a wall and ceiling covering for all types of school rooms. It is available in many sizes, shapes and colors, making possible unlimited designs and color combinations. Nu-Wood builds beautiful pre-decorated interiors, insulates against heat and cold, improves acoustics and reduces noise.

Nu-Wood Interior Finish is a distinctly different product available in Tile, Plank, Board and Wainscot. Each unit is designed to fit mechanically and harmoniously with the other—the completed job having the following outstanding qualities:

1 **TEXTURE.** A unique textured surface which gives walls and ceilings a rich, velvety appearance. A matte surface which reflects light without glare or "Hot Spots."

2 **A NEW, EXCLUSIVE JOINT** treatment on plank and tile which results in a superior application. The tongue and groove eliminates breathing—improves insulation value. The shallow bevel reduces the shadow line in keeping with today's interior decoration technique.

3 **INVISIBLE NAILING** made possible by the new Nu-Wood Clip System.

4 **THERMAL INSULATION.** Nu-Wood brings added insulation to the school building, reducing fuel bills in winter and providing greater coolness in summer. Thermal conductivity .324.

5 **ABSORPTION VALUE.** Nu-Wood absorbs sound, quiets noise, improves hearing.

6 **EASY APPLICATION.** Nu-Wood can be applied directly over cracked plaster or other disfigured walls. In new construction it may be applied to furring strips or framing members.

7 **PERMANENCE.** Nu-Wood requires no maintenance other than occasional cleaning with rubber sponge.

8 **LOW COST.** With these advantages—decoration, acoustical treatment and insulation—Nu-Wood is surprisingly low in cost.

KOLOR-TRIM MOLDING. Pre-decorated wood moldings are especially designed to harmonize with various Nu-Wood shades. They add the finishing touch which makes each job superior in style. Kolor-Trim Moldings make it possible for the carpenter to do the complete interior finish job at low cost.

NU-WOOD KOLOR-FAST

FADEPROOF BEAUTY. For the first time in an insulating interior finish, Nu-Wood Kolor-Fast offers colors which have been pronounced fadeproof by nationally recognized testing laboratories.

HIGH SOUND ABSORPTION. Unlike an ordinary coated board, the exclusive manufacturing process maintains the original high sound absorption of Nu-Wood Kolor-Fast. It quiets noise, corrects faulty acoustics. Sound absorption value .35.

NU-WOOD STA-LITE

LIGHT REFLECTION—76%. The highest light reflection attainable in a commercial product of this type plus a matte surface preferred by lighting engineers.

PERMANENCE. The Florida testing service, after subjecting Nu-Wood Sta-Lite to most severe tests, reports that the surface actually grows lighter with exposure—that most interior finishes turn darker.

SOUND ABSORPTION. Impartial laboratory tests give Nu-Wood Sta-Lite a sound absorption rating of .25—more than enough for a product of this type.

FURTHER INFORMATION ABOUT NU-WOOD KOLOR-FAST AND STA-LITE WILL BE FURNISHED UPON REQUEST

THE CELOTEX CORPORATION

120 S. LaSalle Street
Chicago, Illinois

ENROLLED IN THOUSANDS OF SCHOOLS, CELOTEX SOUND CONDITIONING BRINGS PERPETUAL ENDOWMENTS

This picture of the Hush Girl is a symbol of Celotex Sound Conditioning as used in schools throughout the country. Wherever Celotex Acoustical Products hush noise—in kindergarten, grammar school, high school and college—teaching and studying are made easier. Student failures and disinterest are greatly diminished—all because Cetolex Sound Conditioning endows schoolrooms with less noise and better hearing.

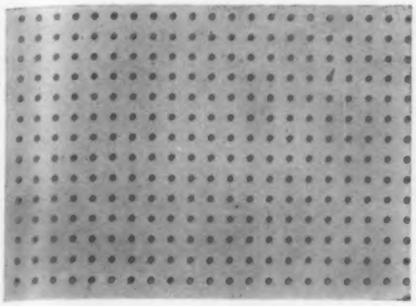
The roll call of American schools that have successfully relied on Celotex Sound Conditioning in the past seventeen years is long and impressive. Whenever and wherever requested, The Celotex Corporation has gladly contributed its completely informative catalogs to schools and universities; and when convenient, speakers from the Celotex acoustical engineering staff have been freely supplied to lecture on Architectural Acoustics.

In principal cities in the United States and in Canada (Dominion Sound Equipments, Ltd.) there are established exclusive distributors for Celotex Acoustical Products. These independently owned and operated concerns provide prompt, efficient, and dependable service in analyzing acoustical problems, recommending the proper material and application, and submitting estimates. The manufacturer is able by this means to assure users of capable, conscientious responsibility for results. Though the cost of complete acoustical treatment of your entire school building may exceed present available funds, a start toward noise reduction can be made at small cost by using Celotex Sound Conditioning in your most troublesome areas. Such areas may include the auditorium, band practice room, typing rooms, certain corridors, or the gymnasium. Why not let us survey your school and suggest proper acoustical treatment where it is needed, with estimates for budget purposes?

WHEN LIGHT REFLECTION IS IMPORTANT, BE SURE YOU CAN PAINT THE ACOUSTICAL MATERIAL YOU BUY

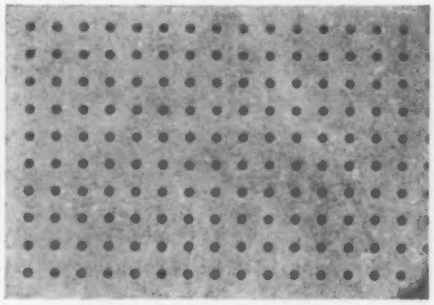
Painted Acousti-Celotex may be washed and cleaned to renew light reflection values until painting is necessary. Note how holes are always kept clear of paint, thus assuring constant and permanent maintenance of original sound-absorbing properties

CELOTEX ACOUSTICAL PRODUCTS



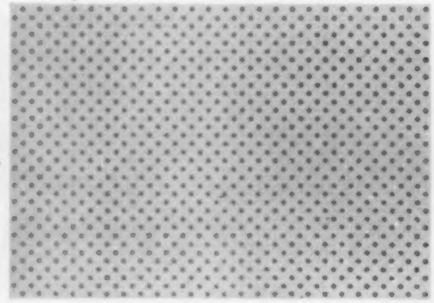
ACOUSTI-CELOTEX

ACOUSTI-CELOTEX (cane or mineral) acoustical tile possesses perforations of controlled diameter, depth and spacing, insuring uniform performance and practical paintability without loss of absorption



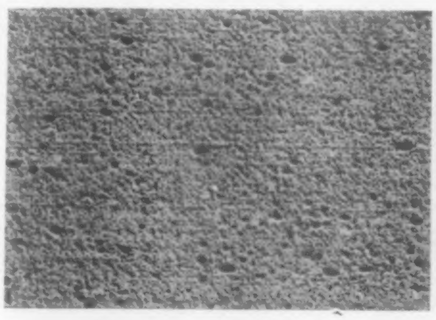
ACOUSTI-CELOTEX
PERFORATED PANEL BOARD

PERFORATED PANEL BOARD FACING is used over sound-absorbing elements which may be varied as required for different parts of a room

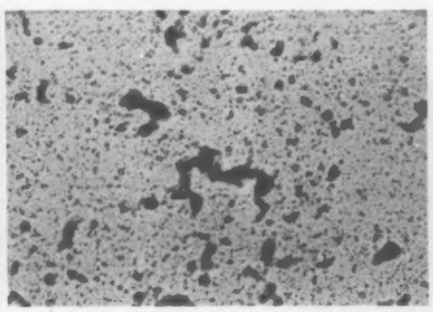


ACOUSTEEL-B

ACOUSTEEL is paintable, perforated steel tile enclosing a sound-absorbing element of incombustible mineral fibre



MUFFLETONE — Standard



MUFFLETONE — Fissured

MUFFLETONE is the name of our precast, porous gypsum tile, available in a variety of integrally mixed, beautiful pastel colors

Q-T DUCTLINER

Q-T DUCTLINER is an acoustical material designed to absorb noise in air conditioning ducts. Made of mineral wool and a special binder in rigid block form, it will not smolder or support combustion

SEND FOR YOUR COPY . . .
While our supply lasts, we will be glad to fill requests for "LESS NOISE — BETTER HEARING." Please give your title when writing

A COMPLETE TREATISE ON ARCHITECTURAL ACOUSTICS

Although specifically designed for practicing architects and engineers, many copies of "LESS NOISE—BETTER HEARING" have also been requested by school and college libraries, instructors in physics and architecture, school superintendents and superintendents of buildings and grounds.

The book contains 93 pages of authoritative data profusely illustrated with photographs and charts representing years of research and experiment. Consider the chapter headings: "Physics of Sound," "Sound Absorbing Materials," "Sound Waves in a Room," "Acoustics of Auditoriums," "Acoustical Correction of Different Types of Room," "Noise Quieting with Acoustical Treatment," and "Sound Insulation."

There is also a bibliography of authoritative acoustical works, available for loan to interested readers.

JOHN J. NESBITT, INC.

Manufacturers of

Heating, Ventilating and Air Conditioning Equipment

Holmesburg, Philadelphia, Pa.

11 Park Place, New York City

The Nesbitt Syncretizer Is Now Available with Non-metallic Casing, Approved for Present Use In Schools with Priority Ratings . . . .

THE IDEA of a non-metallic unit was pioneered and developed by John J. Nesbitt, Inc. The new Nesbitt Syncretizer with Non-metallic Casing answers the wartime need for a ventilating unit using less metal. It requires less than one-third the amount of metal and is substantial and attractive.

The Nesbitt Syncretizer with Non-metallic Casing

TODAY'S MOST HEALTHFUL HEATING AND VENTILATING

Result of years of scientific research and progress, the Nesbitt Syncretizer represents the most advanced thought on heating and ventilating the schoolroom. It brings in and distributes to the classroom a continuous supply of fresh, outdoor air, and "syncretizes" (or harmonizes) it with room air so as to maintain a healthful, comfortable June-like condition, even when the outside temperature is below zero.

DRAFTLESS FRESH AIR WITHOUT OVERHEATING

The Nesbitt Syncretizer prevents drafts, overheating and unpleasant odors. It is adjustable according to any State's laws to deliver all or part outdoor air, but always some outdoor air to occupied classrooms. Its special Air-Stream Minimum Temperature Control provides that all air taken from outdoors is first warmed to a safe minimum temperature, thus preventing drafts. The Room Temperature Control assures that the desired room temperature will be uniformly maintained without permitting overheating.

BEAUTY AND PERFORMANCE

The Syncretizer's simple beauty is conformable to schoolroom needs; it is attractive but not obtrusive. Tests have proved it to be the quietest of units. Its economy of fuel and current wins lasting favor. In competitive demonstrations before school boards, the Nesbitt Syncretizer has outsold all other unit ventilators.

NOW AVAILABLE FOR ESSENTIAL USE

For essential requirements where permits are issued by the Construction Bureau and unit ventilators are specified, Nesbitt Syncretizers with Non-metallic Casings will be available. In many areas, schools are judged essential projects.

RECESSED AND NON-RECESSED MODELS

The Nesbitt Syncretizer with Non-metallic Casing is offered in both recessed and non-recessed floor type, but not in ceiling-type models. It comes in two sizes only: Series 462—capacity 1001 to 1560 CFM and Series 442—capacity 750 to 1000 CFM. All capacities based on Anemometer rating. The units are available with manual or automatic control.

SERIES B THERMOVENTS

For heating and ventilating auditoriums, gymnasiums, assembly halls and similar gathering places there are the Nesbitt Series B Thermovents. Publication 227-1.

EVERY manufacturer's facilities must now be employed to produce war goods or civilian necessities. The whole Nesbitt organization is pledged to producing for Victory.

If Nesbitts can serve you today or tomorrow, please let us hear from you

NESBITT Syncretized Air

"THE GUARDIAN OF SCHOOLROOM HEALTH"

Nesbitt Syncretizers are sold by American Blower Corporation, and John J. Nesbitt, Inc. Complete information is contained in Publication 239. For engineering data, Publication 225-1.

PETROLEUM HEAT & POWER COMPANY

Main Office and Factory: Stamford, Conn.

Oil Burning Equipment—*"Since 1903"*—Fuel Oils

PETRO
Reg. U. S. Pat. Off.

INDUSTRIAL AND COMMERCIAL OIL BURNING SYSTEMS

"Cut Steam Costs for Schools and Universities"

Automatic boiler operation is the aim of cost-conscious management, but for various sound reasons, it may not be feasible in certain plants. Consequently, Petro burners are available for three general methods of operation:

AUTOMATIC—SEMI-AUTOMATIC—MANUAL

Petro's operating economies, proved every month in thousands of installations, are due to principles rather than "features" or gadgets. Experience-developed design for specific application, inherent simplicity, and traditionally fine manufacture are basic in Petro burners.

In automatic operation these are enhanced by two important factors in firing efficiency and fuel economy. These are:

(1) PETRO'S THERMAL-VISCOSITY CONTROL

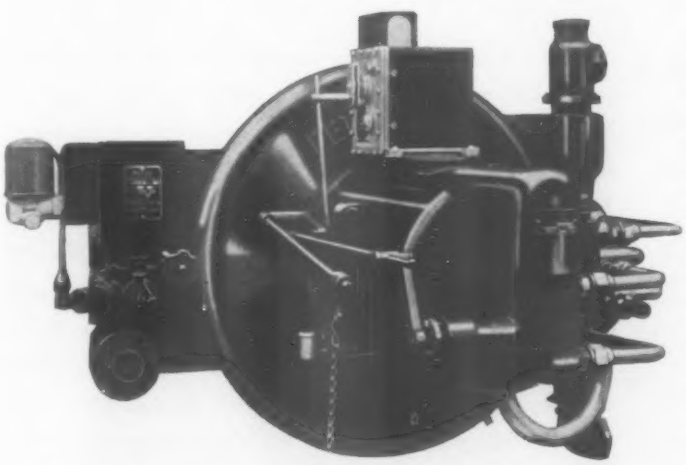
—a well proven system for burning No. 6 or Bunker "C" oil at maximum combustion efficiency under absolute control without any need for frequent manual adjustment—the only method of burning preheated oils which can be called "automatic" legitimately.

(2) MODULATED FUEL CONTROL

—a completely automatic control of high-low operation which permits automatic low fire starting and modulation or acceleration of firing to meet fluctuating steam demands:—maximum combustion efficiency at every stage of firing. Illustration shows modulating motor as mounted on burner (when specified) and arms and linkage through which constant fire-regulation is maintained.

SPECIFYING ENGINEERS will find it helpful to have complete information on these factors which so markedly affect operating costs. Petro Industrial Burner Catalogue may be found in "Sweets," and in "Domestic Engineering" Catalog Files, or copy will be sent gladly on request.

MODEL W-DIRECT DRIVEN, ROTARY CUP TYPE BURNERS



This Burner is a self-contained assembly of motor, fan, pump, rotary cup atomizer and all air and oil adjustment apparatus. Illustrated above is a Petro Model W for Automatic operation on No. 6 (Bunker "C") fuel oil.

Interlocking air and oil control mechanism permits any minimum or maximum operation required within the burner's range of operation. Counter-flow Angular Air Vanes at nozzle increase air and oil turbulence and aid efficient combustion of heavy fuel oils.

Special oil adjustment valve meters oil to rotary cup, yet permits manual operation without disturbing permanent burner adjustment.

CAPACITIES

Model	Motor H.P.	Max. Gals. Per Hour	Rated Capacity Boiler H.P.	Sq. Ft. C. I. Steam Radiation *
W-2½	⅓	11	34	4,800
W-3	⅓	15	47	6,540
W-4	½	25	78	10,825
W-5	1	33	103	14,300
W-6	2	45	141	19,600
W-7	2	62	195	27,150
W-8	3	100	313	43,500
W-9	3	145	454	68,000

W-2½ to W-9 burns No. 5 fuel oil of 300 seconds maximum viscosity at 100° F. Saybolt Universal or any lighter oils without preheating. When heavier No. 5 or No. 6 (Bunker C) fuel oil is used, preheating is required. Models W-2½, 3 and 4 burners, single phase 110 or 220 volt, 50 or 60 cycle. Model W-5 single phase, 220 volt, 50 or 60 cycle.

All models, 220, 440, 550 volt, polyphase, 50 or 60 cycle.

W-2½ to W-8 belt driven type is available in 25, 30, and 40 cycle A.C. for all standard voltages, single or polyphase; also 115-230 volt D.C.

(*) Equivalent Direct Cast Iron Steam Radiation measured at the boiler outlet.

Removable rotary cup and nozzle permits changing shape of flame to suit requirements of any boiler and prevent flame impingement.

Oil pump is a slow speed, permanently packed, self-priming, self-aligning, non-binding or clogging mechanism, assembled as an integral part of burner. Burners also available without integral pump. Motor is cooled by induced circulation of air. Armature shaft is mounted on two deep-groove annular ball bearings. Splash lubrication from the sump which is below the pump drive, lubricates all bearing surfaces in the burner.

WAR NOTE: *While the war lasts Petro equipment can be supplied only on orders supported by the higher urgency rating. In addition to the restrictions on materials, Petro's expanded production capacity is almost totally devoted to ordnance work.*

The above data on Petro Industrial Burners is presented for its value in post war planning and is condensed from the complete catalog which will be sent gladly on request.

STREAMLINE PIPE AND FITTINGS DIVISION

MUELLER BRASS CO.

Port Huron, Michigan

PROTECT THE INVESTMENT FOR THE LIFE OF THE BUILDING BY INSTALLING *STREAMLINE* COPPER PIPE FOR THE PLUMBING AND HEATING SYSTEMS

STREAMLINE bronze solder fittings and copper pipe are a radical departure in conducting systems for plumbing, heating or industrial use. Their unique method of connection has made it possible to use copper piping of hard temper and of a sufficient wall thickness to meet all requirements of actual service. This is in direct contrast to threaded copper pipe, which had to carry a very heavy wall to insure a sufficient thickness to meet service conditions after this thickness had been cut away approximately 50% in the fabrication of the thread. Threaded copper pipe for this reason is naturally very expensive and gives no extra service for its additional wall thickness on the unthreaded portion.

STREAMLINE Solder Fittings are manufactured under U. S. Patents 1,770,852; 1,776,502; and 1,890,998

Illustrating Mechanical Features of the STREAMLINE Fitting

STREAMLINE solder fittings and copper pipe are installed at a price very slightly in advance of rustable materials.

STREAMLINE fittings and copper pipe are ideal for use in all types of educational buildings for all general plumbing and heating purposes: for steam supply, condensate return, cold water, drinking water supply and return, and hot water supply and return piping. Among the many advantages are:

High resistance to corrosion and clogging—Under normal conditions of soil and water, copper does not corrode or rust as iron or steel does. The absence of anchor points due to the continuously smooth waterway through pipe and fitting tends greatly to eliminate clogging.

Light Weight, yet great strength—The STREAMLINE solder fitting, less heavy and consequently less expensive for any given size, produces a connection that is enormously strong and leakproof.

Minimum space required—Although STREAMLINE solder fittings produce enormously strong joints, they are very little larger than the pipe lines which they connect. They do not protrude like screw type fittings. Since these fittings are not screwed into place when connected to the pipe and no space is required for wrench handling, etc., they can be installed very close to each other, thus saving considerable space.

Leaks due to vibration eliminated—Constant vibration has no effect on a joint made with STREAMLINE solder fittings. Its effects are not localized as is the case with screw type fittings, but are harmlessly dissipated throughout the system.

Visual proof an exclusive feature of the STREAMLINE Fitting.—When the mechanic installs STREAMLINE he can tell at a glance that the joint he has made is permanently leakproof without an actual pressure test. This is a valuable asset especially in concealed work.

Cut-away Sectional View of STREAMLINE Tee. Note How Pipe Is Recessed Into the Fitting, Resulting in a Uniform Smooth Waterway

The STREAMLINE solder fitting is not connected by threading or flaring but by soldering, utilizing one of nature's laws—capillary attraction—to form a permanently tight joint of great strength. The joint, in contrast to threaded connections, is actually reinforced and is the strongest point in the line, instead of the weakest.

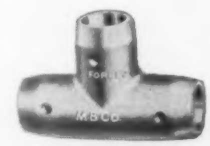
The illustration herewith shows the mechanical features of the STREAMLINE solder fitting. After the joint has been fluxed and assembled in the pipe, it is heated and solder introduced through the feed hole. Capillarity immediately distributes it thoroughly and evenly between the bonding surfaces, producing a joint so strong that in a pulling test, the pipe will actually break while the joint remains without the slightest damage. It requires over 9000 pounds of pull even before the fracture in the pipe occurs. This, of course, is away beyond anything required of it in actual service.

ESPECIALLY RECOMMENDED FOR HEATING PLANTS

STREAMLINE hard copper pipe and fittings are particularly recommended for all heating plants—whether by hot water or steam—a special virtue of copper pipe being its capacity to hold heat with a minimum of radiation, yet to conduct it very rapidly, so that there is a minimum loss of heat when being conveyed from the point of generation to the points of distribution. Since copper cannot rust, the original delivering capacity of STREAMLINE pipe remains the same indefinitely. In all heating plants, we claim greatly increased benefits in all installations made with STREAMLINE, with noteworthy savings in both fuel and material.

Coupling

STREAMLINE pipe and fittings are installed in over four hundred schools and colleges throughout the United States and, in fact, in every type of building construction. They have been specified by leading architects everywhere.



Tee

STREAMLINE fittings are furnished in complete range from ¼" to 10".

Elbow

COPPER FOR VICTORY

In war, as in peace, copper has advantages that are duplicated by no other metal. Its special properties have made it indispensable for many uses . . . in munitions, ships, trucks, tractors, planes, and other essentials. In the present emergency, every pound available is needed by your Government and the industries manufacturing for war use.

When peace comes and copper has done its part to bring victory, it will again become available for water works and allied uses. It will provide again the longest lived, most economical piping that can be produced.

The word STREAMLINE is the Registered Trade Mark of the Mueller Brass Co., Port Huron, Michigan

Write for Catalog.

Cross

THE RIC-WIL COMPANY

Underground Conduit Systems for Heating and Power Pipes

Union Commerce Building, Cleveland, Ohio

AGENTS IN PRINCIPAL CITIES

RIC-WIL

Ric-wiL Interlocking Conduit and Base Drain Foundation, Tile and Cast Iron; Ric-wiL Insulated Pipe Units; "Dry-paC" Waterproof Asbestos Conduit Insulation; Roller Pipe Supports; Alignment Guides; Manhole Covers; Asphalt Impregnated Filter Tape.

Ric-wiL Interlocking Tile Conduit is first quality, vitrified tile of the bell and spigot type. It is shipped in full round sections and split into top and bottom halves as used. Tile is A.S.T.M. double strength, reinforced top and bottom. When installed, bell and special Loc-liP side joints are sealed with portland cement. Loc-liP joint (see cut) is shaped so that cement locks top and bottom halves giving conduit extraordinary rigidity and strength. Leakage is practically impossible.

Sections are all in 2-ft. lengths, sizes from 4 to 27-in. inside diameter. The 27-in. size has sections 2 ft. 6 in. long. Every sixth section has an opening in the bottom half through which a pipe support of the roller type projects to carry the steam, hot water or oil pipes, making pipe supports independent of conduit itself. This opening is closed with cement which reinforces pipe support.

Ric-wiL Interlocking Base Drain Foundation is both a base for supporting and lining up conduit and drain for carrying away water. Top of base drain has slot into which the bell of conduit fits, making sections of conduit and base drain stagger with each other. Pipe support saddles resting on the side shoulders insures perfect pipe alignment.

Cast Iron Ric-wiL Conduit—For extra heavy duty under railroads or where conduit is subject to very heavy loads, Ric-wiL is made of cast iron. Has Loc-liP Joint and "interlox" with tile Ric-wiL—made in all 5 types described in next column. Special heavy duty tile or a cast iron base drain is used with Ric-wiL Cast Iron Conduit.

Dry-paC Waterproof Insulation—A high-grade fibre asbestos processed insulation that is permanently water repellent. Of unusually high efficiency and great natural strength, it will not slump away from pipes and is non-corrosive. Samples sent on request.

Systems Meet All Conditions—Type F System—For steam power and superheated steam. Conduit assures super-efficiency insulated with Dry-paC or Ric-wiL No. 11 Asbestos Insulation, packed around pipes in closed construction.

Type SPC System—For steam heating, power pipes and superheated steam. Insulation is any standard make of sectional pipe covering, kind and thickness depending upon service to be rendered. Internal drainage is provided in this type.

Type DA System—For hot water, oil transmission and condensation returns. Tile and insulation in one, the latter, a diatomaceous earth mixture of high insulating quality, moulded inside the tile and keyed in. This type insulates the pipes from surrounding ground but not from each other, making it specially adapted to carry oil and steam pipes together for oil transmission. Exceptionally easy to install.

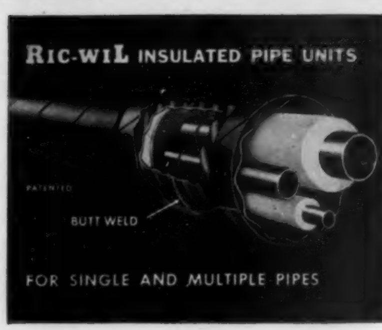
Type DF System—For steam heating, power pipes and superheated steam. This is Type DA with the addition of Ric-wiL Asbestos Conduit Filler to be packed around pipes at a density specified by manufacturer. Filler is a good non-conductor which will not corrode the pipes nor shrink. Dry-paC furnished when specified.

Super-Tile Conduit—To support any average traffic load, or for use in extra wide or deep trenches. Details on request.

Insulated Pipe Units

Ric-wiL factory prefabricated Units come in standard or special lengths for underground or outside overhead work. Complete with steam pipe, insulation, fittings, pipe supports, expansion loops, watertight glands, and all accessories. Armco Hel-Cor Conduit used has thick asphalt coating (of special quality, made to Ric-wiL's own formula) and protective wrapping to meet specific conditions and to resist all deterioration. Choice of insulation including Dry-paC or sectional pipe covering. Connection between units is made either with split connector band, or welded, as preferred. Exceptional strength and durability assured. A complete pre-fabricated system, ready to install in minimum time. The ideal modern method for steam, hot water or oil lines on any type of work where speed and economy are demanded. Write for Catalog.

Engineers: Write for Specifications and Engineering Data.

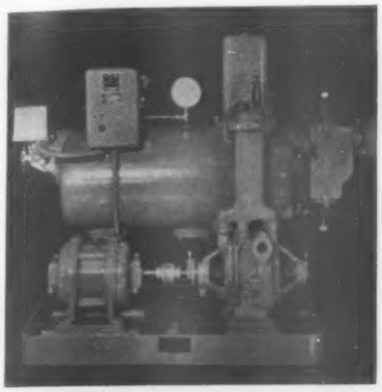


Ask for Catalog S-42 showing all Ric-wiL Systems

THE NASH ENGINEERING COMPANY

222 Wilson Road — South Norwalk, Conn., U. S. A.

SALES AND SERVICE OFFICES IN ALL PRINCIPAL CITIES

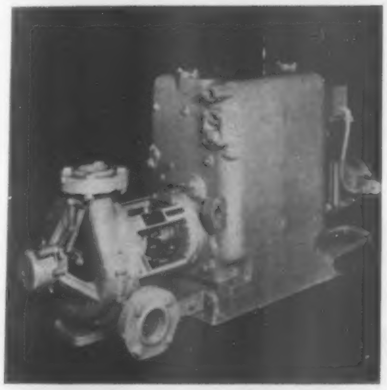


JENNINGS RETURN LINE VACUUM HEATING PUMPS

Standard with the heating industry for over sixteen years. Jennings Pumps remove air and condensation from the return lines of vacuum steam heating systems, discharging the air to atmosphere and returning the water to the boiler.

Two independent pumping units are combined in a single casing—an air unit which handles only air, and a water unit which handles only water. The capacity of each unit is simultaneous capacity. Each handles the full rated capacity independent of the other. Impellers of both are mounted on the same shaft. The pump is bronze fitted throughout.

Supplied either direct connected to standard electric motors, for belt drive, or for steam turbine drive. For continuous or automatic operation against pressures up to 40 lbs. Supplied standard in capacities up to 300,000 sq. ft. E.D.R. Bulletins on request.



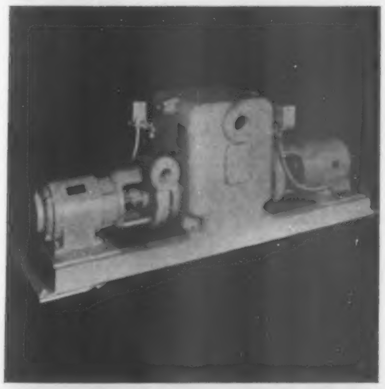
JENNINGS VAPOR TURBINE VACUUM HEATING PUMPS

The Jennings Vapor Turbine Heating Pump combines all of the advantages of the Standard Jennings Return Line Heating Pumps with a new type of drive, a specially designed low pressure turbine which operates directly on steam from the heating mains on any system, requiring a differential of only 5 in. of mercury, and returns that steam to the heating system with practically no heat loss.

This pump affords the economy which goes with a continuous condensation return and steady vacuum, and at no cost for electric current.

The Jennings Vapor Turbine is a safe heating pump, for it functions as long as there is steam in the system, entirely independent of electric current failure. Ideal for Greenhouse, School, and Hospital service.

Furnished standard in capacities up to 150,000 sq. ft. E.D.R. Bulletin on request.



JENNINGS CONDENSATION PUMPS

Jennings Condensation Pumps remove condensation from radiators in return line steam heating systems and pump condensation back to the boiler.

Jennings Condensation Pumps are sturdy and compact in construction, and combine receiving tank, pump and driving motor in a single assembly. Bronze fitted throughout, with Tobin bronze shaft. Impeller is of special design adapted to handling hot water with highest efficiency.

They efficiently remove condensation from radiators, particularly those set below the boiler water line level. Pump casing forms part of return tank, making a compact structure that conserves floor space. Rectangular construction permits installation in corner or against wall.

Jennings Condensation Pumps are furnished in standard sizes with capacities ranging from 1½ to 225 g.p.m. of water, for serving from 1,000 to 150,000 sq. ft. equivalent direct radiation. Bulletin on request.

JENNINGS SUMP AND SEWAGE PUMPS

The Jennings Suction Sump Pump is a self-priming centrifugal pump for handling seepage water and liquids reasonably free from solids. The Suction Sewage Pump is fitted with a non-clog type impeller. Pumps are mounted entirely above the sump where they are always readily accessible. Only the suction pipe is submerged.

There are two moving parts: the centrifugal impeller and the vacuum priming pump rotor. Both rotate without metal-to-metal contact in the casing. Both are mounted on the same shaft that carries the rotor of the electric driving motor, making a compact assembly.

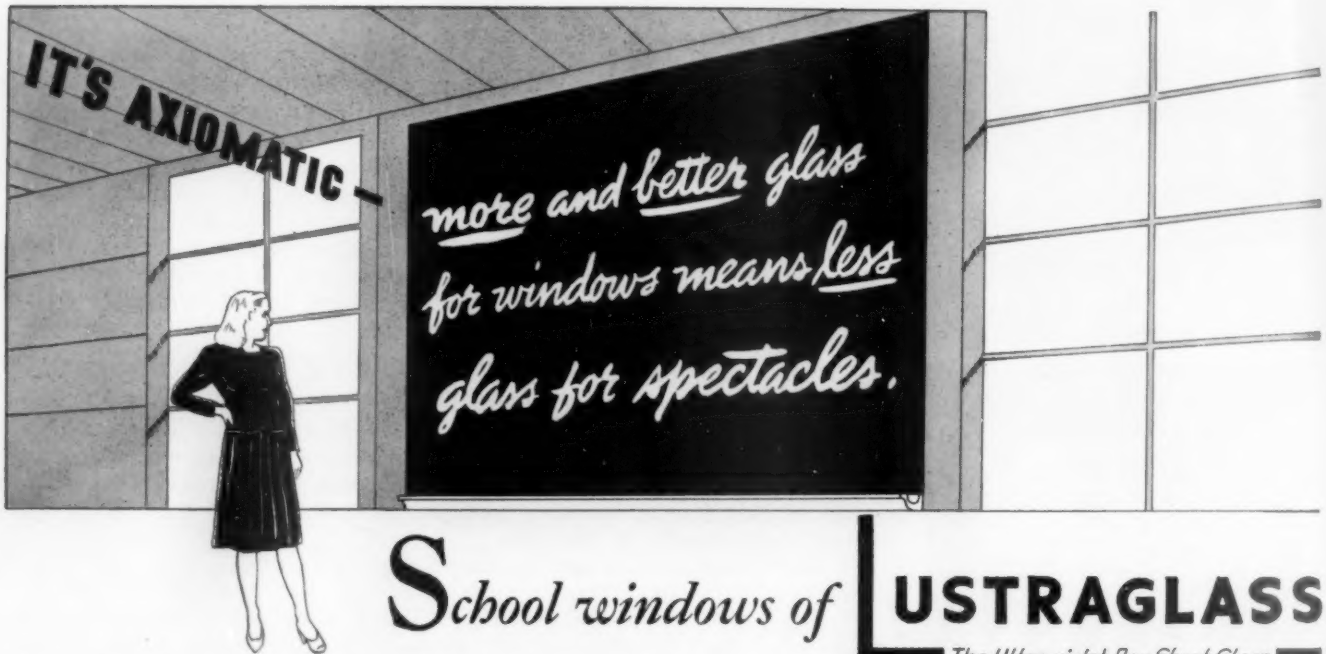
These pumps may be installed away from the pit, or directly over the pit. The Pedestal Type Jennings sets directly on the pit cover, requiring no other foundation.

Capacities and heads to meet all requirements. Bulletins on request.

AMERICAN WINDOW GLASS COMPANY

Manufacturers of Lustraglass, Plexite and Supratest Safety Glass; Lustrablu and Lustragold ornamental glass; Lustra Cover Glass for microscope slides, Armor-Lite Bullet-Resistant Glass; Crystal Sheet, Chipped and Special Glass for Scientific and industrial needs

Pittsburgh, Pennsylvania



School windows of LUSTRAGLASS

The Ultra-violet Ray Sheet Glass

provide many exclusive advantages at no extra cost.

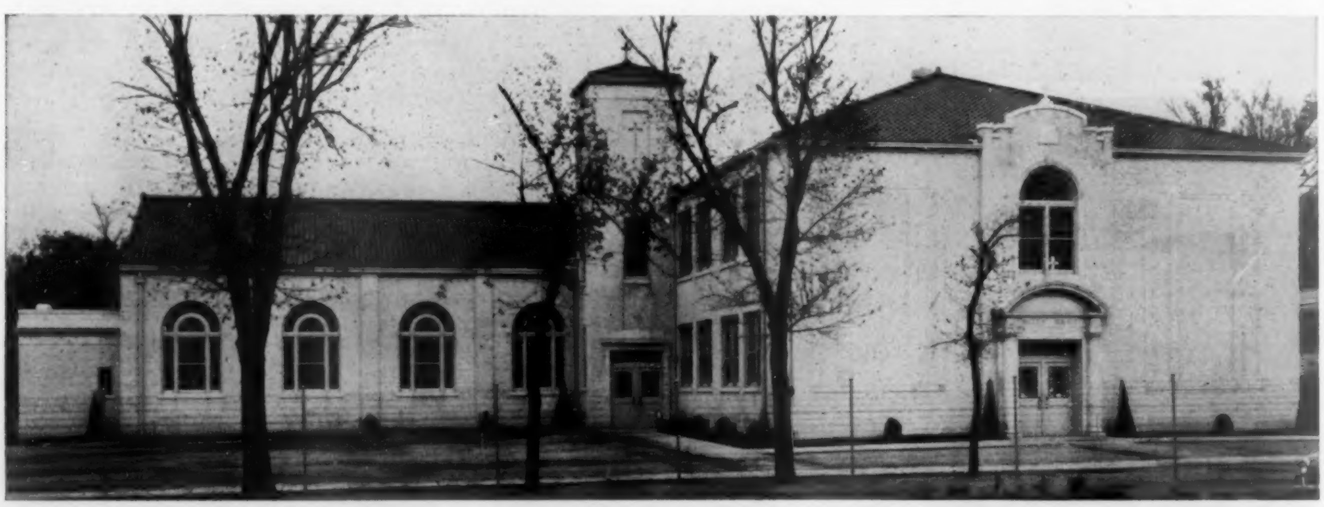
Windows and the glass we use in them are being recognized more than ever as playing a most important part in our daily life. Wherever there is indoor life and activity it is imperative that we let in all the natural daylight possible and that this light be undistorted. This is especially true in the school room where our growing children spend the greater part of each day.

As a result of the demand for more and better light, with less distortion, architects and builders everywhere are insisting on windows of Lustraglass and the many exclusive advantages it provides at no extra cost.

Compared with ordinary window glass, Lustraglass . . .

- transmits more of the ultra-violet rays of sunlight
- is obviously freer from distortion
- has much less of the greenish cast common to other glass used for glazing
- offers a jewel-like luster that enhances the appearance of any building
- and last, but not least, Lustraglass *costs no more.*

Write Lustraglass into your next specification—it has no equal. Booklet 4107 and Windowgraph Chart free.



HOLY NAME GRADE SCHOOL, TOPEKA, KANSAS Glazed throughout with Lustraglass · Architect: Ben H. Byrnes, Salina, Kansas
Contractor: J. H. Casson & Sons, Topeka, Kansas · Glazier: Curtis Companies Incorporated

AMERICAN ABRASIVE METALS CO.

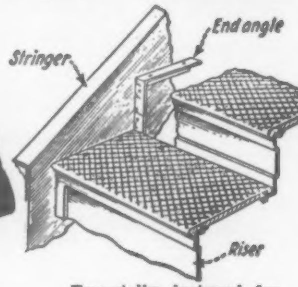
IRVINGTON, N. J.

Offices in Principal Cities

ANTI-SLIP PRODUCTS FOR FLOORS, STAIRS, RAMPS AND WALKWAYS

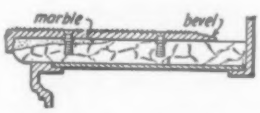
FERALUN ANTI-SLIP TREADS

Feralun is available in hatched, plain or fluted surfaces

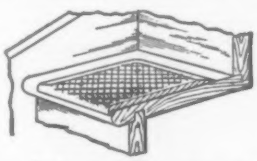


Especially designed for school installation

Feralun is cast metal with abrasive particles of near-diamond hardness imbedded in the surface. Particles give perfect grip to wet or dry soles. Feralun Treads require no maintenance and usually last the life of a school. Feralun is made in many types for stair treads, floor plates and door saddles. Write for further information giving details of your needs.



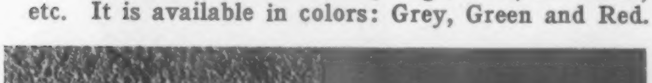
Style A—Long lip for worn wood or marble treads. Maximum depth of lip 2" from underside of tread



Style A — For new or slightly worn surfaces

FERA-FLOW NON-SLIP FLOOR PAINT

A quick, low-cost method of slip-proofing walkways is to paint with Fera-Flow. This product is a high-grade floor paint containing non-slip particles. It provides all the protective qualities of good paint and is non-slip wet, oily or dry. Fera-Flow will out-wear the ordinary painted surface and is just as easy to clean. Excellent for shower rooms, manual training rooms, cafeterias, etc. It is available in colors: Grey, Green and Red.



Granular Fera-Flow surface grips even a wet sole

Conventional floor has a smooth, slippery surface

MARTEX NON-SKID

Martex is a plastic composition having a high percent abrasive aggregate. On new or only slightly worn stairways it is applied in recessed strips along the nosing and tread surface. It provides complete protection against slipping and checks stair wear. Badly worn treads can be restored to original contour with Martex spread over entire worn area. Martex is extremely durable and bonds perfectly to wood, stone, concrete or metal.

Installation of MARTEX

New Stairs

Worn Stairs

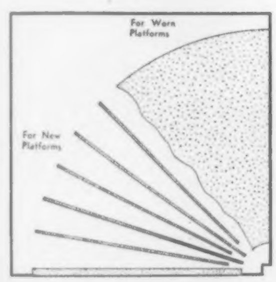


Diagram of sunburst application for platform. Solid coverage for old, worn areas

WE HAVE THE PRODUCT TO CORRECT YOUR SLIPPING HAZARD . . . WRITE GIVING DETAILS OF YOUR PROBLEM

THE SAFE TREAD COMPANY, INC.

30 Vesey St., New York, N. Y.

Abrasive Impregnated *Cast Metal* (Iron, Bronze and Aluminum) Stair Treads, Door Saddles, Floor Plates, Etc.

Manufacturers of
"SAFE TREAD"
AGENTS IN PRINCIPAL CITIES

Abrasive Impregnated *Vitrified Ceramic Tile* and Terrazzo Aggregates in 16 Colors for antislip floors

The responsibility for providing slip-proof walkways for the safety of children and teachers has been established by the courts.

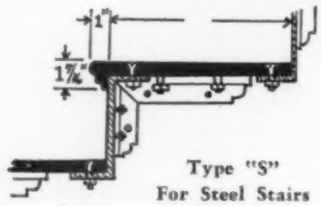
Maintenance costs are likewise of utmost importance.

The use of "SAFE TREAD" **for new construction or repairs** will insure the highest degree of **Nonslip** qualities and the greatest amount of **wearability.**

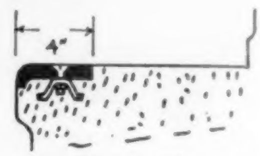
When Ordering or Requesting Quotation Specify kind of metal, type of nosing and surface design, length, width back of nosing and quantities of each size; if tile, or terrazzo aggregate, state **color,** size, and quantities or size of area to be covered. If unusual shapes are required, furnish detail sketch or template. If for repairs, advise type of material to be covered and any other data that will help us to function.

Submit your walkway problems to us; we shall be glad to help you solve them.

"SAFE TREAD" METAL
For New Construction



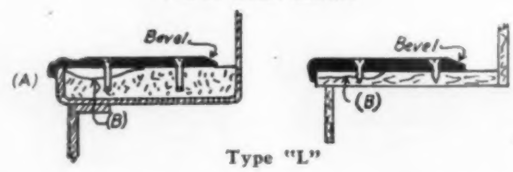
Type "S"
For Steel Stairs



Type "XL"
For New Concrete

Many other forms for Stair Treads and Nosings, Floor Plates, Trench Covers, Expansion Joints, Etc., in "Safe Tread" Metal.

FOR REPAIRS

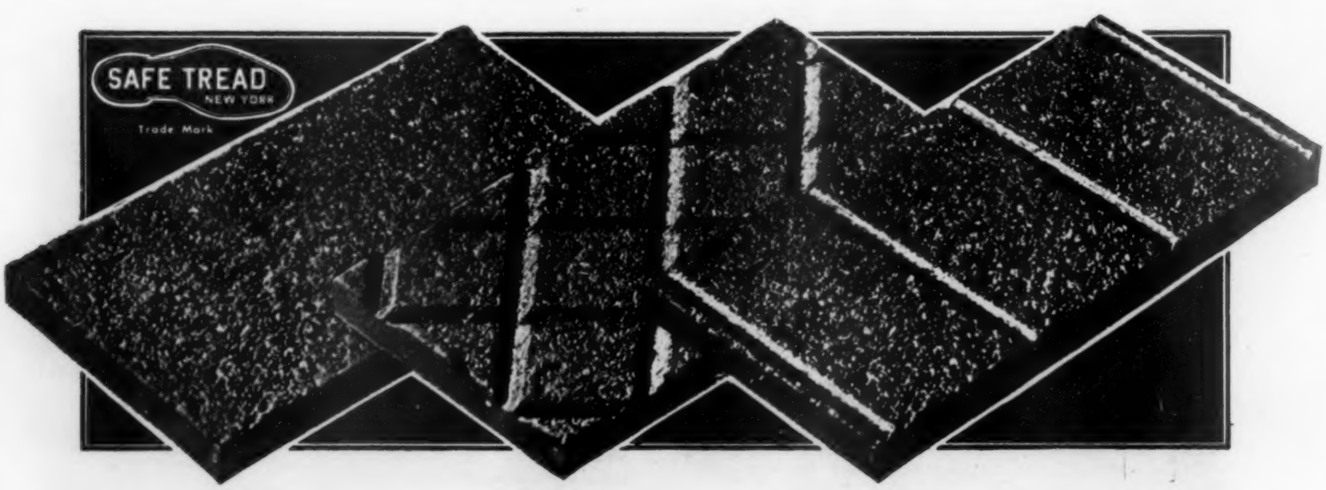


Type "L"

Lip ¼, ½, ¾ or 1" deep to cover worn area, with beveled back and ends, carried to within 2½" of back and 3" of ends of existing treads, with worn areas filled with magnesite cement, is recommended practice for repairing worn stair treads.

"SAFE TREAD" TILE AND TERRAZZO

Aggregates are the only effective anti-slip vitreous anti-slip ceramics.



Plain **Hatched** **Grooved**

THE TEXAS COMPANY

Manufacturers of

TEXACO ASPHALT SHINGLES and ROOFING

TEXACO ROOFING DEALERS EVERYWHERE east of the Rockies

The Texas Company — Texaco Asphalt Shingles and Roofing — District Offices:

Atlanta, Ga.
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FACTS ABOUT TEXACO ASPHALT ROOFING FOR INSTITUTIONAL USE

Economical: Dollar-for-dollar, today's Texaco Asphalt Shingles and Roofing buyer gets a better, longer-life roof than ever before.

Attractive: Texaco Asphalt Shingles are available in colors and patterns that will blend with and enhance the beauty of the buildings they cover.

Fire-resistant: The Fire Underwriters' Label of inspection is on every bundle. A fire-resistant Texaco Roof may even permit a reduction in insurance rates . . . dependent, of course, on local conditions.

Water and weather-resistant: The reason is self evident . . . asphalt is one of the greatest weather and water-proofing substances in the world today.

Meets rigid requirements: Texaco Asphalt Shingles and Roofing meet U. S. Army, Navy and other governmental specifications—meet or exceed structural specifications for educational buildings, both for new work and re-roofing.

Most popular type: U. S. Department of Commerce statistics show that asphalt roofing products are America's favorite over all other types.

Reputation of integrity: Texaco Asphalt Shingles and Roofing maintain the standards of quality and dependability established by each of the more than 350 petroleum products of The Texas Company.

Quickly available: The widespread distribution facilities of The Texas Company, through the local Texaco Roofing Dealer, assure prompt deliveries and helpful cooperation.

★ ★ ★

FOR SAMPLES, COLORS AND SPECIFICATIONS SEE THE NEAREST TEXACO ROOFING DEALER OR WRITE TO THE NEAREST OFFICE OF THE TEXAS COMPANY.

ONE OF MANY SCHOOL BUILDINGS ROOFED WITH TEXACO STRIP SHINGLES. The Junior High School at Henryetta, Oklahoma. Texaco shingles add beauty and color, and assure years of economical protection.

SEND FOR *FREE* COPY OF THIS VALUABLE ROOFING DATA BOOK

68 pages of facts, diagrams, specifications, application methods—everything you want to know about asphalt roofing products. Write to The Texas Company, Roofing Division, Dept. ASU, 135 East 42nd St., New York, N. Y.

CRANE CO.

Valves, Fittings, Pipe, Plumbing, Heating, Pumps

General Offices: 836 South Michigan Avenue, Chicago, Illinois

NATION-WIDE SERVICE THROUGH BRANCHES, WHOLESALERS, PLUMBING AND HEATING CONTRACTORS

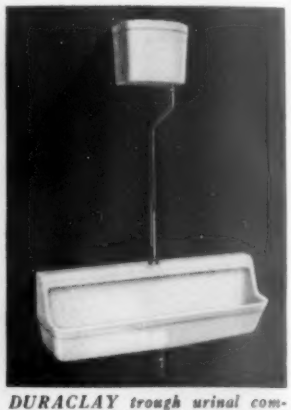
SCHOOL PLUMBING THAT PROTECTS HEALTH WHILE CONSERVING CRITICAL MATERIALS

By combining maximum utility with a minimum use of critical materials, Crane plumbing eliminates the need for *compromising* with accepted standards of quality and dependability for school service. Fixtures are vitreous china or Crane glazed Duraclay, both non-critical materials. Trim is of galvanized iron, minimizing the use of vital metals. Yet, efficiency is not sacrificed as operating parts and valve seats are brass.

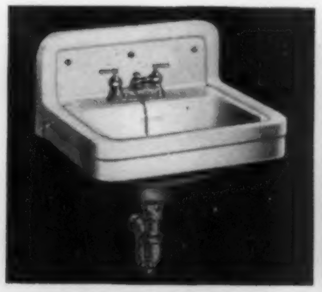
Typical items are shown. Your local Plumbing Contractor or Crane Branch will gladly advise you regarding proper selection of equipment for replacement or new installations.

IMPORTANT—Educational institutions may automatically apply a Priority of AA2X for most of their essential plumbing and heating repair and maintenance requirements. We suggest you obtain from the nearest Crane Branch a copy of the new WPB regulation CMP 5A which explains how to apply this new high priority.

RAPIDWAY blowout wall-type closet with elongated rim, flush valve and vacuum breaker, and with open front plastic seat. (CE 11-380)

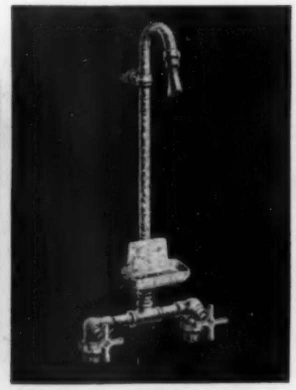


DURACLAY trough urinal complete with galvanized flush pipe, vitreous china automatic tank and galvanized trap. (CE 15-750)



VICTORY CANTONMENT vitreous china lavatory with 6-in. back, 14 x 9-in. rectangular basin, soap depression and supporting screws to mount directly on wall. Size 18 x 15 in. (CE 764)

COTTAGE DURACLAY two-compartment apron sink with 6-in. back. Overall dimensions: 42 x 20 in. Basins are 6 in. deep. Fitted with (CE 32-751) galvanized sink fitting with swinging spout, and twin waste with open strainers. Comes with oil-treated hardwood reversible drainboard with cleats. (CE 19-563.)

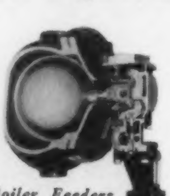


Galvanized iron exposed 2-valve shower with brass Newsleeve *trimming units, reversible yoke with union connections for supplies from ceiling or floor; with* Economy *head and soap dish. (CE 4667)*

THURSTEND vitreous china drinking fountain with integral strainer, Purflo *angle stream jet, vandal-proof base with regulating screw and self-closing valve. Galvanized iron bracket and trap. (CE 9161)*

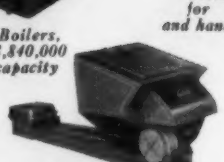
HEATING EQUIPMENT FOR REPAIRS AND MAINTENANCE

Sectional Boilers, up to 3,840,000 Btu. net capacity



Boiler Feeders for automatic and hand-fired systems

Low pressure Pop-Safety Valves for steam boilers



Coal Stokers, from 60 to 350 pounds per hour capacity

Radiator Venting Valves for all type systems

Crane offers a complete line of improved equipment and specialties for the repair and maintenance of all types of school heating systems. Insure maximum winter comfort for your school with this equipment. Typical items are shown.

CRANE

VALVES · FITTINGS · PIPE
PLUMBING · HEATING · PUMPS

THE HALSEY W. TAYLOR CO.

Manufacturers of Drinking Fountains and Coolers

Warren, Ohio

AGENTS IN PRINCIPAL CITIES

PRODUCTS

Halsey Taylor Drinking Fountains; Combination Cooler Drinking Fountains in Iced Water or Electric Types.

DISTINCTIVE FEATURES THAT APPEAL TO ARCHITECT AND SCHOOL AUTHORITIES ALIKE

It was during the first World War that Halsey Taylor Drinking Fountains were introduced. Today, they are still accepted among the country's foremost fountains, because of their modern design, their distinctive patented features that spell convenience and sanitation alike, and their wide variety of models from which to choose. That is why they are still a preferred specification of architects and builders, whether for schools or other public buildings; industrial plants, hospitals or churches.

You buy more than a mere fountain when you buy Halsey Taylor Drinking Fountains. You buy definite assurance of trouble-free service, positive health-safety, maximum convenience, built-in patented features exclusive with Halsey Taylor!

It is in school operation that a fountain finds its greatest use as a factor in hygiene. When pupils drink from Halsey Taylor Fountains day after day, it is this assurance of health-safety that more than pays for the care in selecting the right make of fountain—and that make usually is Halsey Taylor, practically a standard in school installations the country over. Their most valued features are:

1 — Practical Automatic Stream Control

An automatic device maintains constant height in drinking stream regardless of line pressure variation. Stream never too high, never too low.

2 — Ideal Drinking Mound

The two-stream projector with latest type guard makes the side stream both practical and health-safe, removing objections found with ordinary side-streams.

3 — Definite Sanitation

Drinking mound is formed by the converging of two streams of water, setting up a localized drinking mound which makes it impractical to drink from any other point but the ideal height of the mound. Fingers or lips cannot come in contact with or contaminate water source. It is impossible to squirt the water.

No. 3914

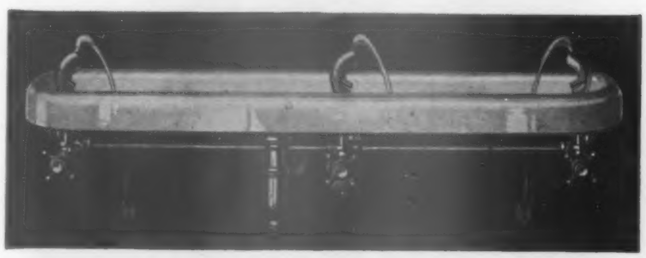
Pedestal Type—No. 3916

No. 3901

One of many attractive pedestal and wall types

Battery Types
Many two- and three-part battery types especially adapted to school installations

No. 3912



No. 2703

FOUNTAINS FOR EVERY REQUIREMENT

These pages show a few of the various types of Halsey Taylor Drinking Fountains. There are many models from which to select, all most modern in styling, all with the fundamental Taylor features. Send for catalog.

THE F. W. WAKEFIELD BRASS COMPANY

1943 Yearwood Park, Vermilion, Ohio

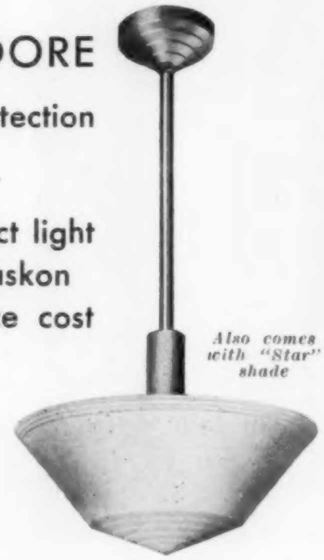
Over Thirty Years a Manufacturer of Lighting Equipment

DISTRIBUTORS IN 108 CITIES

The COMMODORE

. . for eyesight protection and Better Light

- Glareless, indirect light
- Molded from Plaskon
- Low maintenance cost



Also comes with "Star" shade

SCIENTIFICALLY designed to give the right light for easy seeing and eyesight protection, the Wakefield COMMODORE makes any schoolroom, old or new, more cheerful and more effective. With its simple, light-weight shade, molded from Plaskon, the COMMODORE also brings users these important advantages: 1. Unusually efficient indirect light; 2. Easy cleaning; 3. High degree of safety; 4. Far less breakage; 5. Low maintenance cost; 6. Smart, modern appearance.

SEE THE DIFFERENCE . . . before and after
Here in one unretouched photograph you see a striking comparison of lighting results. Taken from outdoors it shows at a glance how the COMMODORE improves seeing conditions. Upper room in this Ashland, Ohio, school lighted with old units; lower room with COMMODORES

Guarding eyesight has new importance now, with wartime adult-training classes meeting in schools. COMMODORES provide 30 footcandles of diffused light for such a class at the Case School of Applied Science

HOW THE COMMODORE HELPS GUARD SIGHT

According to Electrical Testing Laboratories, famous New York research and testing organization, the COMMODORE gives 86% of the light from the bare bulb. That means more light than most indirect fixtures . . . and it is soft, generous, diffused light . . . to make seeing easier, put far less strain on young eyes. For best results, light colored ceilings are necessary.

MODERNIZES SCHOOLROOMS OVERNIGHT

Night classes resulting from the government educational program to meet wartime needs, emphasize the necessity for better lighting in many a school. The COMMODORE provides a practical answer since it can modernize seeing conditions at once . . . quickly makes your worst-lighted room your best lighted. It provides new eyesight protection for daytime pupils, too.

Class room Kellogg, Idaho, consolidated school. COMMODORES benefit the whole community because, at night, the school serves as a community center (Photo courtesy American Seating Co.)

Incidentally, better light from the COMMODORE'S simple, modern design not only makes a world of difference in the appearance of the room but in the attitude of the people in it! They are more attentive; study more effectively; and feel fresher, in rooms lighted with COMMODORES.

WRITE FOR INTERESTING BOOKLET

Filled with case histories from schools all over the country, this booklet brings you the benefit of other schools' experiences with better light . . . offers tested suggestions on how to have it . . . outlines factors to watch in addition to lighting and pictures the results obtained. This booklet provides information which will be genuinely helpful to school superintendents and school business officials. Write for your copy.

THE CINCINNATI TIME RECORDER CO.

Cincinnati, Ohio

CINCINNATI LANDIS

TIME is our BUSINESS!

SCHOOL MANAGEMENT is Big Business. For almost half-a-century CINCINNATI-LANDIS Clocks, Signaling Systems and CTR Time Recorders have provided dependable, accurate service to schools and colleges. Complete information on master and secondary clocks—program machines—push button boards—program bells, buzzers, horns—employees' time recorders—time stamps—synchronous program systems, etc., gladly sent on request.

Consult CTR representatives without obligation regarding your timekeeping, time signaling and time recording problems.

INTERNATIONAL BUSINESS MACHINES CORPORATION

INTERNATIONAL TIME RECORDING DIVISION

Time Recorders, Electric Time, Program Signaling, Fire Alarm, Telephone, and Industrial Paging Systems

WORLD HEADQUARTERS BUILDING

590 Madison Avenue, New York, N. Y.

BRANCH OFFICES AND SERVICE STATIONS IN THE FOLLOWING CITIES

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Neenah, Wis.
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PRODUCTS

Self-regulating Electric Time Systems, Program Signaling Devices and Systems, Tower and Outside Clocks, Attendance Time Recorders, Job Time Recorders, Time Stamps, Recording Doorlocks, Watchclock Systems, Athletic Event Timers, Fire Alarm, Interior Telephone, and Central Control Sound Distribution Systems.

TIME RECORDERS, ELECTRIC TIME, AND PROGRAM SIGNALING SYSTEMS

International provides a wide variety of timing equipment suitable for the time-indicating, -signaling, and -recording needs of every type of institution, business and industrial organization. Most of the various devices operate either independently or as auxiliary units in the Self-regulating Electric Time System—a system which automatically maintains uniformly accurate time service throughout a building or group of buildings. The International Master Time Control supplies correct time for an unlimited number of auxiliary timing devices and supervises their performance. Once each hour every unit in the system is compelled to compare itself with system time and to make any necessary corrections.

A Typical Tower Clock Built Specially to Conform with Architectural Plan

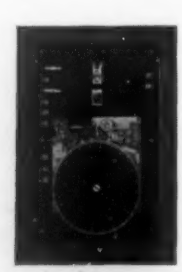
Secondary or Wall Clock

Printime Stamp

Mercurial Pendulum Master Time Control

All-electric Direct Read Attendance Time Recorder

Job Time Recorder



Metal Disc Program Signal Control

All Products Shown Are Available only Under Priority Allocations

FIRE ALARM SYSTEMS

International Fire Alarm Systems are specifically designed to provide the most dependable type of life and property protection. They are furnished in many different types to meet the varied local and State fire regulations, but all conform to a single standard that insures positive operation.

Outstanding characteristics of International Systems are: simplicity in initiating alarms; certainty that the act of pulling a lever or breaking the glass of an alarm station will set the signals into operation; and certainty that the alarms will be heard distinctly throughout the protected area.

Data sheets available in all International Offices.

Break Glass Station

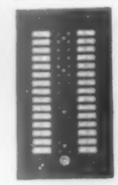
Fire Alarm Gong

Typical Fire Alarm Control Panel

All International equipment, including Fire Alarm Systems, carries the approval label of the National Board of Fire Underwriters.

INTERIOR TELEPHONE SYSTEMS

Cradle Type Telephone



Telephone Keyboard

Surface Wall Telephone

International Telephone Equipment applies strictly and exclusively to intra-communication as a means of purely local administration, management or convenience, and in no way conflicts with public telephone service. It is an automatic administrative aid that permits rapid and efficient transmission of information between individuals and departments.

International Telephone Instruments are of high quality, designed in a variety of convenient styles. Almost any kind or size system is available from a simple two-station line to a standard size switchboard exchange serving hundreds of phones.

ELECTRICAL LABORATORY EXPERIMENTAL PANELS

International Laboratory Panels are built to meet the requirements of the scientific laboratories of modern schools and colleges.

INDUSTRIAL PAGING SYSTEMS

These systems provide a rapid, convenient, and sure way to locate individuals within a plant or commercial organization, or to reach all members of the personnel simultaneously, with important information or emergency instructions.

The equipment consists of a centrally located transmitter and a sufficient number of sound reproducers to insure complete coverage of a working area. The transmitter is usually placed at or near the private telephone switchboard and controlled by the telephone operator. The sound reproducers are of several types, scientifically designed to operate with maximum efficiency according to the location. In addition to several types for indoor use, there are weatherproof reproducers for outdoor installation.

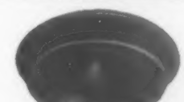
Operation of the International Paging System is exceedingly simple—any announcement or request for the location of an individual in the plant is made by the telephone operator who presses a key and repeats the request into the transmitter. The message will be heard throughout the entire plant or only in a selected area, depending on the key or keys pressed.

This system serves also for the rapid dispatch of emergency instructions to maintenance men, distribution of chime or other mechanical sound dismissal signals, and "broadcasting" of either phonograph or radio programs.

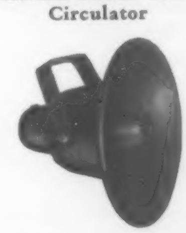
IBM Sound Equipment manufactured also for schools, colleges, and other institutions.

ENGINEERING AND SPECIFICATIONS-WRITING SERVICE

IBM branch offices are staffed and equipped to render expert engineering and specification-writing service for the various types of low tension equipment listed above. This service is immediately available. Data Sheets on request.



Medium Power Sound Circulator



Medium Power Directional Voice Projector

Central Transmitting Station for PBX Switchboard
Transmitter mounted on adjustable swivel

Two-way Metal Sound Reproducer

High Power Sound Circulator

Typical Amplifying Unit
Consists of pure Class "A" high-gain amplifier with output of 2400 units of coverage.

THE STANDARD ELECTRIC TIME COMPANY

97 Logan Street, Springfield, Mass.

BRANCH OFFICES IN PRINCIPAL CITIES

Manufacturers of

"Standard" Electric Time, Telephone, Fire Alarm Equipment and Laboratory Test and Distribution Systems

PROGRAM CLOCKS

For Schools, Universities and Public and Private Buildings

"Standard" Electric Time Systems are designed and constructed throughout to deliver dependable, precision performance throughout many years of service. Standard Master Clocks are easily and quickly adjusted to meet any program changes that may be required. Program clocks are furnished in either tape or metal disc types. All master clocks are self-winding and designed to control as many secondary clocks as are required for the building. Standard automatic hourly correction control assures accurate time in every room, thereby preventing confusion and delays.

Secondary clocks are available in a wide variety of designs to harmonize with architectural or decorative schemes.

***Above:* Master Clock**
***Right:* Secondary Clock**

TELEPHONE SYSTEMS

Standard Telephone equipment provides time-saving inter-communication for modern school practices. Consists of combination bell control board and central telephone station. Raising of receiver signals office. All calls go through central station, permitting supervision of conversations if desired. May be installed in combination with program bells utilizing same signals and bells. Wall and hand phone models. Entire system is efficient and simple in construction, requiring practically no servicing or attention.

***Above:* Standard Central Telephone Station with hand microphone set**

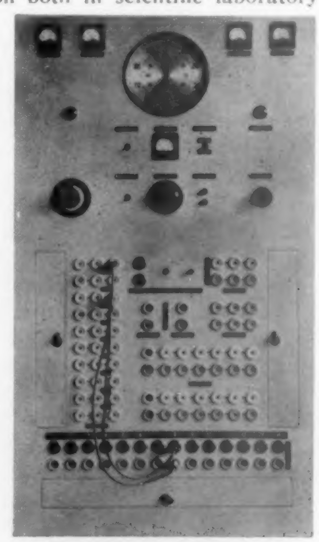
***Left:* Flush wall set with watch case receiver**

LABORATORY TEST AND DISTRIBUTION SYSTEMS

"Standard" Laboratory Panels and accessory equipment perform an important function both in scientific laboratory instruction and in vocational training in electricity. They provide a flexible, convenient method for distributing various voltages and types of current to tables and benches. Connection changes can be rapidly made. Exclusive features include jack construction, perfect contact, colored for ready selection in various voltages, sectional battery charging, and convenient table receptacles.

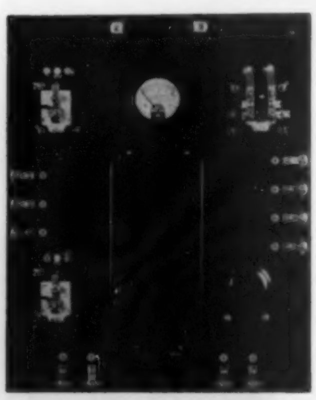
Standard laboratory equipment increases students' interest in laboratory and shop work, as well as facilitating the instructor's program.

There are many types of Standard Panels for practically all branches of electrical study.



Typical Laboratory Experimental Panel

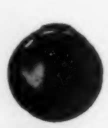
FIRE ALARM SYSTEMS



Closed Circuit Panel and Cabinet

"Standard" Fire Alarm equipment is designed to render unfailing service in emergencies. Materials and workmanship, both of the equipment itself and of the installation, comply with the most exacting requirements and are approved by the National Board of Fire Underwriters. It is available in supervised closed circuit or open circuit types, also with coded stations.

Test can be made readily by opening any station with key. Various types of bell and horn signals, depending on specific needs, are available. Systems may be furnished when so required to be automatically tested each day from program clocks before the daily school session.



ELECTRIC STOP CLOCKS

These are manufactured in a wide variety of types for accurate, split-second timing. Valuable in Science—Psychology and Gymnastic Courses.

THE WARREN TELECHRON COMPANY

Manufacturers of *Telechron* * Timekeeping Systems for Modern Schools

General Office and Factory—Ashland, Mass.

SALIENT FEATURES OF TELECHRON TIMEKEEPING SYSTEMS

CLASSROOM CLOCK

CLASSROOM CLOCK

I. Quiet operation.

II. No local master clock required.

III. Operate direct from the regulated alternating current.

IV. Available for 115 volt or 24 volt operation.

V. Each timekeeper equipped with self-starting, sealed-in-oil rotor, bi-pole, synchronous motor.

VI. No oiling, cleaning, winding or regulating.

VII. Available for individual installation or as part of a Telechron centrally controlled system.

VIII. Clocks available with sweep second hands.

IX. Clock hands move continuously around the dial.

X. National Board of Fire Underwriters' approved type construction throughout.

Your Architect has SWEET'S ARCHITECTURAL CATALOG Giving Complete Specifications

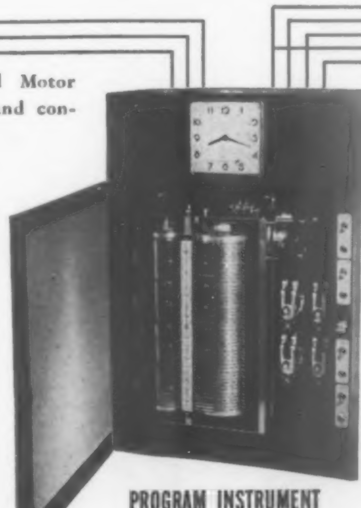
CLASSROOM BUZZER

CORRIDOR BELL

YARD GONG

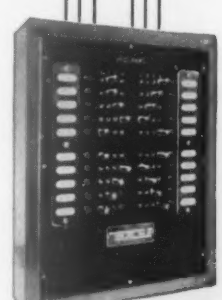
Typical Telechron MDMR (Manual Dual Motor Reset) System for a school, with signals and control board

CENTRAL CONTROL



PROGRAM INSTRUMENT

SIGNAL SUPPLY



SIGNAL CONTROL BOARD

TO AC SUPPLY

* *Telechron is the trade-mark, registered in U. S. Patent Office, of Warren Telechron Company.*

THE KINNEAR MANUFACTURING CO.

2240–2260 Fields Avenue, Columbus, Ohio

Manufacturers Exclusively of Rolling Doors and Grilles

PRODUCTS—Wood or Steel Rolling Service Doors, Automatic Fire Doors and Shutters, Metal Rolling Grilles, Wood Rolling Partitions and Wood or Steel Upward-Acting Doors.

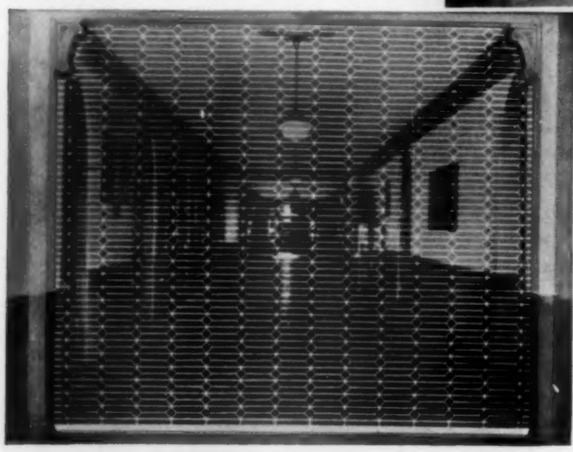
GENERAL—The Kinnear Manufacturing Company pioneered and have devoted their entire effort for the past 45 years to rolling or Upward-Acting type Doors and Grilles. They have established the reputation throughout the world as specialists in doors that save floor and wall space, operate more conveniently, reduce maintenance expense through unusual durability and that can be built for old or new buildings for inside or outside use.

Kinnear Motor Operated Rolling Service Door—Wood or Steel

ROLLING DOORS—Kinnear Rolling Doors are composed of either a flexible wood or metal curtain which coils above the lintel, similar to a window shade. They can be installed either on the face of the wall or between the jambs when concealment of the mechanism is desired. Springs provide perfect counterbalance. They can also be operated manually, mechanically or electrically. Built of the finest materials and to high manufacturing standards they give years of dependable service.

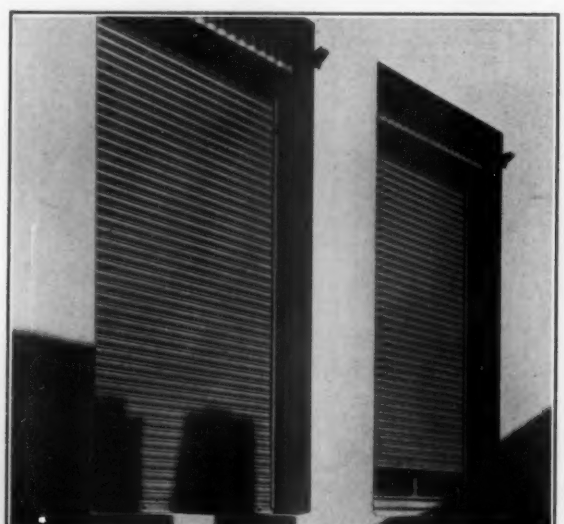
METAL ROLLING GRILLES—Operating on the same principle as the Rolling Door, the Kinnear Rolling Grille is a permanently installed and attractively designed barrier that is remarkably strong when closed and locked, but out of sight when opened. When down, it admits air and light, and does not obstruct vision, making it particularly applicable to all types of interior and exterior openings as well as hallways in school buildings. The grille proper is of remarkable strength and artistically designed of steel bars spaced close enough to prevent the admittance of large projectiles or a man's hand. For locking in closed position a lock is furnished. The Kinnear Rolling Grille may be mounted on the face of the wall with brackets and coils entirely above the bottom of the lintel and with edges of guides flush with the face of opening jambs; or where headroom is limited and grille cannot be installed on the face of the wall it may be mounted in the opening.

AUTOMATIC FIRE DOORS AND SHUTTERS—Kinnear Fire Doors, though suitable for service purposes, are "labeled" and equipped with mechanism for automatic closure in case of fire. They are suited for installation in outside or inside door or window openings and in general construction, operation and mounting are similar to Steel Rolling Service Doors. To insure maximum fire protection they are equipped with an auxiliary push-down spring to insure positive closure; a governor for controlling speed of curtain closure; auxiliary hood to protect counterbalance mechanism; and other features in excess of the requirements of the Underwriters' Laboratories. Their superior design has proved its worth in many major conflagrations.



Metal Rolling Grille for Inside or Outside Use

Permanently installed but may be rolled up out of sight. When closed, admits air, light and vision. Also, if desired, may be locked to prevent raising.



Automatic Fire Shutters for Windows or Doors

BRANCH OFFICES

Boston	Philadelphia	New Orleans	Cleveland	Detroit	San Francisco
New York	Washington	Pittsburgh	Cincinnati	Chicago	Baltimore

AGENTS IN ALL PRINCIPAL CITIES

KINNEAR
ROLLING DOORS

JOHN E. LINGO & SON, INC.

Established 1897

Manufacturers of
Metal Flagpoles

29th Street & Buren Avenue
Camden, New Jersey

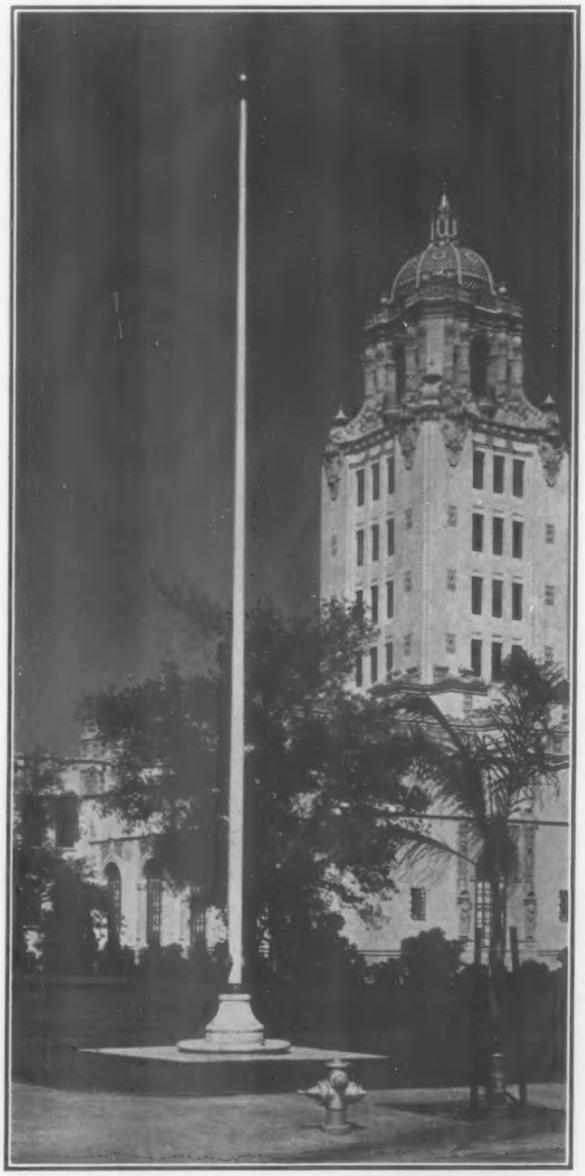
Telephone: Camden 487

TWO DISTINCT TYPES OF STEEL FLAGPOLES

CONTINUOUS STRAIGHT TAPERED FLAGPOLES

Continuous Straight Tapered flagpoles are made of new high grade open hearth steel, have a smooth uninterrupted exterior surface throughout without visible joints and offsets, and resemble a wooden flagpole in appearance. They are standardized in lengths from 20 ft. to 200 ft. These poles are carried in stock and prompt shipments can be made.

Continuous Straight Tapered flagpoles are ideal as replacements of wooden flagpoles, for not only is the appearance the same but the steel pole affords lightning protection, unlimited life and dependability, not usually found in wooden flagpoles.



50 Feet Above Grade, Continuous Straight Tapered Heavy Type Steel Flagpole, City Hall, Beverly Hills, Calif.

SWAGED SECTIONAL FLAGPOLES

Swaged Sectional flagpoles are fabricated in sections of new full weight copper bearing steel pipe with hydraulic die-swaged, telescoped and shrunk joints, made without the use of bolts, rivets, pins, screw couplings or lead calking. They are standardized in lengths from 15 ft. to 200 ft. These poles are carried in stock and immediate shipment can be made.

CATALOGUES AND SERVICE

60-page general catalogue and descriptive pamphlets giving full information, details, specifications, prices, etc., promptly mailed on application. Our Engineering Department will gladly assist you in planning your flagpole installations most satisfactorily and economically, without obligation on your part whatsoever.

FACILITIES

John E. Lingo & Son, Inc., is noted for its ability to produce metal flagpoles promptly, regardless of height, diameter, or quantity. Our large stock of material, and extensive plant facilities usually enables us to ship flagpoles quicker than any other similar establishment. By pledging our full cooperation to the U. S. Government during the Emergency, our manufacturing facilities are devoted to defense work. Defense orders must be given preference but non-defense orders will be taken care of as quickly as possible.

QUALITY OF PRODUCTS

NEW MATERIAL **EXCLUSIVELY** IS USED IN THE MANUFACTURE OF "LINGO" FLAGPOLES. You are guaranteed that our pipe and tubing is new, full weight and mill tested. Affidavits and mill certificates attesting to the use of new material gladly furnished if desired. We do not use second-hand, untested, mill rejected, rerolled or light weight material. Red lead and other nontransparent primers serve as an ideal medium for hiding inferior materials and construction, so "LINGO" flagpoles are painted a shop coat of nonrust transparent varnish which permits immediate and positive inspection of the material and construction used. Your selection of a "LINGO" flagpole assures a high quality product, designed by pioneer flagpole manufacturers and constructed by competent mechanics.

Inspection of Your Present Flagpoles Now May Save Lives Later!

CORNELL IRON WORKS, INC.

ESTABLISHED Since 1828

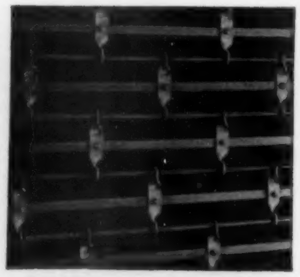
36th Avenue at 12th Street, Long Island City, N. Y.
102 REPRESENTATIVES IN PRINCIPAL CITIES

Telephone: STillwell 4-3880-1-2-3

PRODUCTS

ROLLING GRILLES and GATES, in steel, wood, other metals; SLIDING GRILLES in steel or other metals; ROLLING DOORS and SHUTTERS in steel and wood; Underwriters labeled rolling STEEL FIRE DOORS; complete line of UPWARD ACTING DOORS in wood or metal; MOTOR OPERATORS.

Makers of fine doors for over one hundred and ten years. CORNELL IRON WORKS, INC., owes its origin to George Cornell, who purchased his employer's metal business July 29th, 1828, in New York City. **Send for Catalog U.**



Close-up view of ROLLING GRILLE curtain, CORNELL Standard Butterfly Type

CORNELL ROLLING GRILLE in school corridor, Kansas. Side guides and overhead coil are concealed in jambs and ceiling

ROLLING DOORS AND ROLLING GRILLES

The doors proper are made up of interlocking metal slats running in vertical metal side guides, flexible to coil. Steel curtains are hot galvanized. War Production Board restrictions on the use of metal doors have greatly stimulated the demand for Cornell Wood Rolling Doors. Wood slats strung on metal tapes form the curtain of wood rolling doors, or grilles.

Rolling Fire Doors are labeled by Underwriters' Laboratories, Inc., for fire walls, etc.

Cornell Iron Works, Inc., are the originators of the Rolling Grille in America. Cornell Rolling Grilles operate like rolling doors, but they do not block light, air, or vision. They have been widely accepted for school corridors, etc. Can be completely concealed when open. Rolling Grilles are made of $\frac{5}{16}''$ round hard drawn galvanized steel bars running continuous horizontally from jamb to jamb and locked into rolled steel vertical side guides. The horizontal bars are flexibly connected by unbreakable vertical steel links; permitting entire grille to coil overhead.

Patented Locking Device for Rolling Grilles is workable from either side. A combination Rolling Door and Grille has been designed.

Perspective section thru Wood Rolling Door showing curtain and shaft

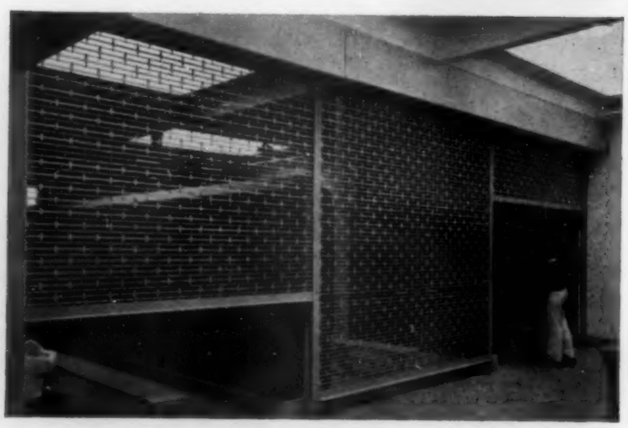
(*At Right*): LABELED ROLLING STEEL (Llenroc) FIRE DOOR, coiling under lintel in the opening between the jambs. Shown in section. Note the overhead counterbalancing shaft, used both in rolling doors and rolling grilles; and the enclosing hood. Side guides may be concealed in the wall and the overhead coil hidden in the ceiling

CORNELL *SLIDING* GRILLES

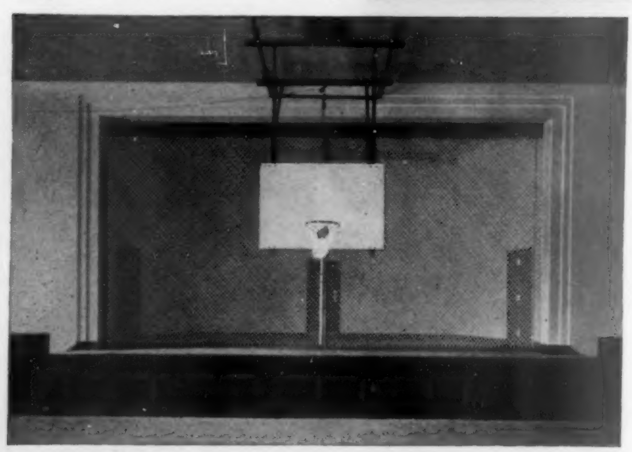
Cornell Sliding Grilles give high protection at exceptionally low cost. It is a patented steel curtain of heaviest galvanized chain link factory fence, extended to any height of opening by galvanized rods running to track above. The grilles can be used anywhere to keep out intruders and allow free circulation of air. The construction makes it possible to nest the sliding Grilles at the side of an opening in a space only ⅙ of the opening width. Grille will travel around a curve, and lie at a right angle to opening if there is 10" room available from edge of jamb.

Cornell Sliding Grilles are recommended for school corridors, as a low priced substitute for Rolling Grilles; for auditoriums and stages; for gymnasium and court windows, entrances, gates or partitions; and for athletic and parking areas.

(*Right*) Close-up of CORNELL *SLIDING* GRILLE
Note cap at each top joint.
Standard Size Grille, 10' x 12', complete $58.50 f. o. b. factory.



Three CORNELL ROLLING GRILLES separating locker rooms from gymnasium; Castlemont High School, Oakland, California



Showing use for large SLIDING GRILLE in combination auditorium and gym in New Jersey School

TRAFFIC & STREET SIGN COMPANY

Flag Poles Made of Steel, Copper-Bearing Steel, Stainless Steel, Bronze and Aluminum

78 Foundry Street
Newark, N. J.

CO-OPERATION WITH ARCHITECTS AND SCHOOL OFFICIALS

Due to our many years of experience in handling floodlight, sign, radio and flag pole problems of all kinds, we are able to offer architects, contractors and building owners a well rounded service in planning, detailing and specifying the flag pole and equipment best suited to each individual installation, location factor, and budget limitation.

We have an unusually wide selection of stock bases, and shall be glad to forward sketches of them. Complete catalogue will be sent on request.

We are also equipped to fabricate special bases in accordance with architects' sketches.

We suggest that rough sketches of contemplated flagpoles be submitted to us—in order that we may prepare details, specifications and estimates of complete costs. All services offered by **Traffic & Street Sign Co.** are, of course, without charge or obligation.

We likewise are able to recommend the maximum length and number of sections that assure the most economical freight rate to any part of the country.

CONTINUOUS TAPERED FLAG POLES

Continuous tapered flag poles are manufactured in two types: **Continuous straight taper, and Continuous entasis taper.** Straight tapered poles for roof and ground setting in copper-bearing steel are carried in stock up to 80 feet, and have a standard taper of approximately 1 inch in 7 feet. Quick delivery can be made on entasis taper, special taper, and standard taper poles up to 200 feet.

TELESCOPED SECTIONAL FLAG POLES

Telescoped sectional flag poles are manufactured in three types: **standard, heavy, and extra heavy.** Stock sizes in copper-bearing steel furnished in lengths up to 100 feet in both roof and ground-set poles. Quick delivery can be made on poles up to 200 feet. All the joints are die swaged and shrunk.

SAFETY NOTE

Architects working on new school buildings as well as all educational purchasing officials are urged to investigate the advantages for safety of steel as opposed to wood in flag pole construction. Wood poles which to all outward appearances are in good condition may have rotted inside to a point where they are early victims of the next strong blow. Furthermore, a good steel flag pole close to a building is excellent protection against lightning. Steel poles not only safeguard adjacent structures but can also be struck by a bolt without danger of collapse.

**Bloomfield Junior High School
Bloomfield, N. J.**

THE NEW "CADET" FLAG POLE

To meet the growing demand for a continuous tapered flag pole of light weight and at a cost within the reach of every school budget, **Traffic & Street Sign Co.** offers the "Cadet." This new flag pole has the same construction and proportioning, the same uninterrupted surface as our standard continuous straight tapered poles — but is reduced in height to 40 feet or less. (This permits a reduction in wall thickness and in weight.) **It is** built strong and safe — for trouble-free service under all conditions. It is guaranteed to withstand a wind pressure of 90 miles per hour. Its newly designed halyard truck assures satisfactory operation at all times. It can be ground set (with or without base); roof set (with braces or penetrating roof); or wall set (with a wide variety of supports). It can also be used as a light-weight outrigger pole. Stocked in four sizes for immediate delivery at surprisingly moderate cost.

OTHER PRODUCTS

"Slow," "Caution," "School Zone" signs, Parking Regulation signs, Posts and Standards for all type signs, Radio poles, Floodlighting Poles, etc.

(For further detailed information refer to Sweet's Catalog)

SECTION II
OPERATION AND MAINTENANCE

HEATING AND LIGHTING EFFICIENCY ON A COLLEGE CAMPUS

By FREDERICK L. WHITNEY

Administration Research Secretary, Colorado State College of Education, Greeley

Heating Plant Efficiency Units

THE president of a well-conducted institution of higher education should require routine annual reports from his superintendent of buildings and grounds in terms of a useful number of unit figures derived from the operation of his campus heating plant. At the same time, the research office of the business department should gather whatever comparative data are obtainable from similar outside situations and from representative commercial plants with total operating periods. This practice, on the part of college and university administrators, is obviously a matter of simple business efficiency. During the present national emergency, it is an index of loyalty. Such an attitude is a necessity, not only in state-supported educational institutions, but in those dependent on endowment.

Illustrative of the minimum of information needed as measurement of operating efficiency, the following units are suggested:

A. Boiler efficiency

1. BTU basis
2. Unit evaporation
9. Fuel fired
4. Steam consumed

B. Cost of operation

1. Steam produced
2. Fuel
3. Wages
4. Repair and miscellaneous items

The administrator does not have to be a heating engineer to understand the significance of these efficiency units. He will, however, be able to interpret them usefully if the man in charge of his plants explains the calculations and the true meaning of the data he reports.

Boiler Efficiency

*1. **BTU Basis.***—Table 1, one of a total of 75 used in a recent 2-year check at the Colorado State College of Education, gives basic data in determining boiler efficiency on the BTU basis in terms of percentages. (Coal fired should be carefully weighed for each 24-hour operating period. This is necessary.) Summations give the monthly and annual totals.

By contract, the fuel used by the college was of 10,012 and 9,710 BTU rating; and Column 3 gives annual heat values available. An underfed-unit pulverizer was used, and coal was burned in suspension in a combustion chamber. Daily integrator readings from the circular chart on each boiler gave pounds of steam produced (see Column 4). Then, comparison of Columns 3 and 4 gave BTU values for each pound of steam used. By dividing this into a constant (970.4), the percentage of boiler efficiency is found.

It can be understood that all measures of heating-plant efficiency will be related to continuity of full-time operation. For this reason, educational institutions cannot hope to run their plants on the same level of efficiency attained with 12-hour 24-month periods. Further, the type of pressure, whether high or low, affects unit figures. For example, a recent report from a paper factory in Saint Paul, Minn., gives boiler efficiency as 87.5%. In the Colorado

TABLE 1

EFFICIENCY OF THE MAIN HEATING PLANT FOR TWO CONSECUTIVE TWELVE-MONTH OPERATING PERIODS, COLORADO STATE COLLEGE OF EDUCATION, GREELEY, COLORADO, 1939–1940

12-MO. PERIOD	SLACK COAL USED (LBS.)	BTU PRODUCED (THOUSANDS)	STEAM PRODUCED (1,000 LBS.)	BTU PER LB. OF STEAM	BOILER EFFICIENCY (%)
1	2	3	4	5	6
1939–1940	5,815,210	81,864,213	51,008	1604.93	60.5
1940–1941	6,603,730	64,122,218	49,902	1284.92	76.2
24-mo. period	12,418,940	145,986,431	100,910	1446.71	67.1

TABLE 2

CUBAGE AND STUDENT-UNIT COSTS IN THE MAIN HEATING PLANT, COLORADO STATE COLLEGE OF EDUCATION, GREELEY, COLORADO, 1939, 1940

FISCAL YEAR	ANNUAL BILL	COST PER 1,000 CU. FT.[1]	COST PER STUDENT-UNIT[2]	COST PER 1,000 LBS. OF STEAM[3]
1	2	3	4	5
1939–1940:				
Slack coal.	$8,397.74	$1.40	$3.57	$0.16
Wages....	4,887.00	0.80	2.08	0.10
Repair, etc.	518.69	0.09	0.23	0.01
Total...	13,803.43	2.29	5.88	0.27
1940–1941:				
Slack coal.	$9,554.38	$1.46	$4.38	$0.19
Wages....	4,147.00	0.63	1.90	0.08
Repair, etc.	417.66	0.06	0.19	0.01
Total...	14,119.04	2.15	6.47	0.28

[1] Cubage, 1939–1940, 6,017,812; 1940–1941, 6,562,341.
[2] Enrolment, eliminating duplicates, 1939–1940, 2,349; 1940–1941, 2,182.
[3] 1939–1940, 51,008,000; 1940–1941, 49,902,000.

State College of Education survey, calculation was made for 7-month cold-weather operating periods. This raised the percentages to 83.9 and 77.7. The heating engineer of a midwestern state university, who is secretary of the National Association of Superintendents of Buildings and Grounds, calculates boiler efficiency as 74.6% and 78% for his institution. From another state university in the northwest comes a unit figure of 83%. The average of 7 of these figures received from an inquiry to 15 institutions is 76%.

*2. **Unit Evaporation.***—This index of boiler efficiency gives the number of pounds of steam produced for every pound of fuel used. (See Columns 2 and 4 of Table 1.) Obviously, unit evaporation depends upon all operating factors, as well as on the type of boiler and fuel firing. If inexpert student help is permitted in the plant, not only is steam production likely to drop but, as was the case in one institution, the boiler must be reset and new tubes put in. The average unit evaporation of 5 college heating plants was 7.7. The paper factory on full-time operation reported an efficiency figure of 10.3.

*3. **Fuel Fired.***—Four or five important efficiency units for fuel consumption may be calculated. Coal is the fuel used as the basis for all of the comparative data given in this article. In nearly every plant, it is slack. One western university uses gas. Average tons of coal used per day should be calculated to get local time-series trends. For general comparison, building cubage units may be derived; but better still are firing figures transmuted to degree-day basis. Tons of coal fired annually per 1,000 cu. ft. of building space heated were .505 and .462 on the Greeley campus. The only comparison available is with Womrath's 1932 check of the Chicago public high schools (.346 tons of coal per 1,000 cubage). These coal-use figures are made more meaningful by taking into account the ratio between inside and outside temperatures during operating periods. The heating and ventilating *Degree-Day Handbook* recommends 65° F as a standard for inside reading.[1] The difference between this and the average outside temperature smooths out raw operation figures. In the case of firing, the degree-day figure means that, for every degree of this difference, a given number of pounds of coal is used. On the Greeley campus, this degree-day unit amounts to 592.6 and 610.3. No comparisons were reported from other institutions. A summation of degree-days for the year gives a useful figure. For the Greeley region, this is 6,440; for Chicago, 6,315. Locally, it appeared that .078 and .072 tons of coal per 1,000 cu. ft. per 1,000 degree-days were used. In Chicago, the figure was .055.

*4. **Steam Consumed.***—In addition to the evaporation unit given above, steam consumption should be read daily, and summations and averages calculated. The obtained average of pounds (thousands) per day is, of course, not comparable; but this figure may be reduced to degree-day units, as in the case of fuel used. Pounds of steam per degree-day in Greeley figured 16.5 and 7.1. Better still, deviation from annual averages may be used, or deviation from the results of a trial run, as a final efficiency measure for both fuel and steam, as the criterion for operation over any time period is a straight line. All calculations of this showed jagged humps in the curves during the hot summer months when, because of the part-time

[1] *Degree-Day Handbook*, by Clifford Strock and C. H. B. Hotchkiss, The Industrial Press, N. Y. C., 1937, p. 225 ff. Standard inside reading of 65° based on 24-hour average of 16 hours at 70° and 8 at 55°.

TABLE 3

THE FOURTEEN-YEAR TREND OF UNIT FIGURES IN THE COST OF ELECTRIC LIGHT AND POWER, COLORADO STATE COLLEGE OF EDUCATION, 1927–1940

FISCAL YEAR	ANNUAL BILL		STUDENT-UNIT		FLOOR-SPACE UNIT		CUBAGE UNIT	
	Amount	Trend	Cost	Trend	1,000 sq. ft.	Trend	1,000 cu. ft.	Trend
1	2	3	4	5	6	7	8	9
1927–1928	$5,225.60	100	$1.97	100	$18.96	100	$1.32	100
1928–1929	5,724.76	110	2.27	115	19.65	104	1.43	108
1929–1930	6,125.60	117	2.57	130	23.07	122	1.53	116
1930–1931	7,208.80	138	2.75	140	23.48	124	1.72	130
1931–1932	6,593.20	135	2.61	132	20.95	110	1.50	114
1932–1933	5,428.00	104	2.46	125	17.10	90	1.21	92
1933–1934	4,327.00	83	2.03	103	13.63	72	0.96	73
1934–1935	5,192.00	99	2.31	117	16.36	86	1.16	88
1935–1936	5,284.00	101	2.48	126	16.65	88	1.18	89
1936–1937	6,386.00	122	2.98	151	16.91	89	1.22	92
1937–1938	7,745.32	148	3.63	184	19.82	105	1.45	110
1938–1939	9,059.18	173	3.85	195	21.95	116	1.62	123
1939–1940	9,282.76	178	3.91	198	20.49	108	1.47	111
1940–1941	9,990.86	191	4.58	232	20.46	108	1.45	110
Average	$6,683.79	...	$2.83	...	$19.25	...	$1.37	...

operation of colleges and universities, maximum efficiency cannot be expected.

Cost of Operation

Ultimately, the president and the controller are interested in expenditure units for the cost of operation of their heating plants. As among the efficiency units above, basic inquiries ask about fuel used and steam production. Table 2 gives the local totals and unit costs for a 2-year trend. Space will not be used here for their interpretation. The mean report from 7 college and university plants gives a cost of $0.255 for every pound of steam produced (see Column 5). In the paper factory, it was $0.37. The average of 4 reports on the cubage unit was $1.82 per 1,000 cu. ft. (see Column 3). No outside reports on student-units (Column 4) have been received.

The derivation and exchange of heating-plant efficiency units such as these ought to lead toward greater economy in operation on many campuses. It would make more meaningful the passage marked "5. Operation and maintenance of physical plant," found in the 1935 report of the National Committee on Standard Reports for Institutions of Higher Education. Further, the National Association of Superintendents of Buildings and Grounds might well study the problem of the establishment of tentative norms for unit figures applicable to their situations. As a rule, boards of directors understand better and are more interested in total cost figures, not in operating data or unit costs. But the president and the controller should have more analytical evidence to support the decisions they must make. They cannot permit themselves to guess.

A Time-Series Study of Electric Light and Power

A SURVEY and time-series analysis of the use of electric light and power in the buildings of Colorado State College of Education has included trends of meter reading and cost for the 14 years since October, 1927. This includes the 23 buildings on the master meter. Lighting of the stadium and the athletic field are in another account. For the last two fiscal years, detailed tabulation has also been made of use for typical days and weeks to determine diurnal curves as well as those for the week and through the seasons of the fiscal year. A sample array of building costs has been calculated also.

Electricity is bought of a local company, which transmits it from a central plant near Boulder, about 60 miles to the southwest. Table 3 gives the trend of the annual cost to the college. The total bill has nearly doubled in 14 years. This reflects the college building program, which has increased floor space and cubage to values 171 and 174 from the 1927-1928 basis. Rank order correlations of Column 2 with floor-space and cubage arrays show that the latter is the better base for unit-cost computation (+.352 and +.945). This makes the cubage unit-cost (Column 8) more significant than the figures of Column 6. It is seen that student enrolment does not seem to be a factor in meter reading. The fact is that attendance has steadily decreased through the fourteen-year period, and the correlation with Column 2 is only +.129.

As the master meter is read each month, the bill paid, and accounts checked, the 14-year time-series in Table 4 is useful. In particular, the trend values for each of the items of use and cost are significant. As in Table 3, rather smooth positive increases are found in meter readings and cost; and the rate values decrease quite steadily to less than one-half the average of 1927-1928.

A constant campaign for economy in the use of electric light is the policy of the college administration. This is imperative not only in the handling of public funds, but the educative value to the student body is important also. The superintendent of buildings and grounds, the faculty members, and the students all have partial control of light and power use. In the setting up of standards for economy and efficiency, it would be desirable to have separate meters in each building. Comparative efficiency could be measured then by building units. Further surveys could be made in terms of a tentative norm of 30 foot-candles, by reading a light meter at determined positions in each room and in the halls. As a result of these checks, needed adjustments of outlets and wattage might be discovered. On the Colorado State College of Education campus, however, it is not possible to get meter readings for each building; but for the current year, the annual 1940-1941 unit cost of $0.0205 per square foot of building space has been used and the twenty-three buildings put into an array of total costs. The

TABLE 4

TIME SERIES OF FOURTEEN MONTHLY AVERAGES OF POWER AND LIGHT LOAD AND COST, COLORADO STATE COLLEGE OF EDUCATION, 1927–1940

Fiscal Year	Kilowatt Hours		Rate		Cost per Month	
	Item	Trend	Cents	Trend	Bill	Trend
1	2	3	4	5	6	7
1927–1928	14,454	100	3.03	109	$435.47	100
1928–1929	17,408	120	2.71	89	477.06	111
1929–1930	18,868	131	2.71	89	510.47	117
1930–1931	24,500	170	2.45	81	600.73	138
1931–1932	24,150	167	2.27	75	549.43	126
1932–1933	22,700	157	1.99	66	452.33	126
1933–1934	18,133	125	1.98	65	360.58	104
1934–1935	21,633	150	2.00	66	432.66	83
1935–1936	22,450	155	1.96	65	440.33	99
1936–1937	37,600	260	1.41	47	532.17	122
1937–1938	39,193	271	1.64	54	645.44	148
1938–1939	44,452	308	1.66	56	754.93	173
1939–1940	52,967	366	1.46	48	773.56	178
1940–1941	59,800	414	1.39	46	632.57	145
Average	29,879	...	2.05	...	$556.98	...

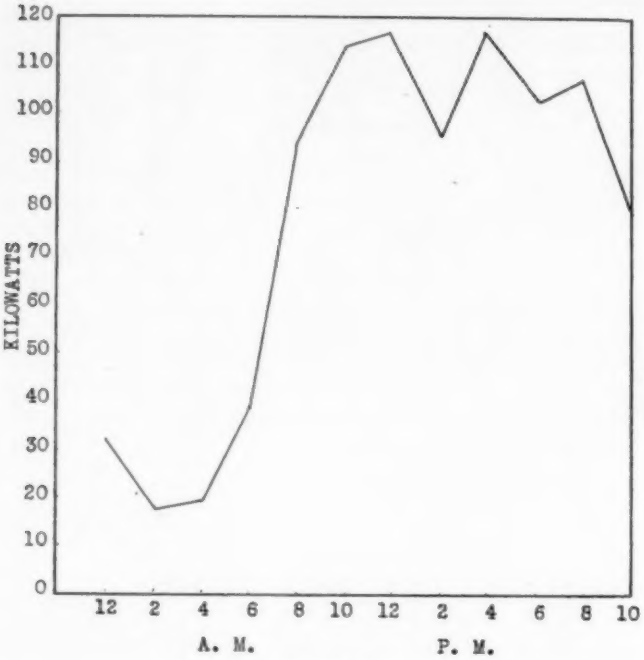


FIGURE 1

Average daily curves of kilowatt hour load on the master meter for four typical weeks, Colorado State College of Education, 1939-1940 and 1940-1941

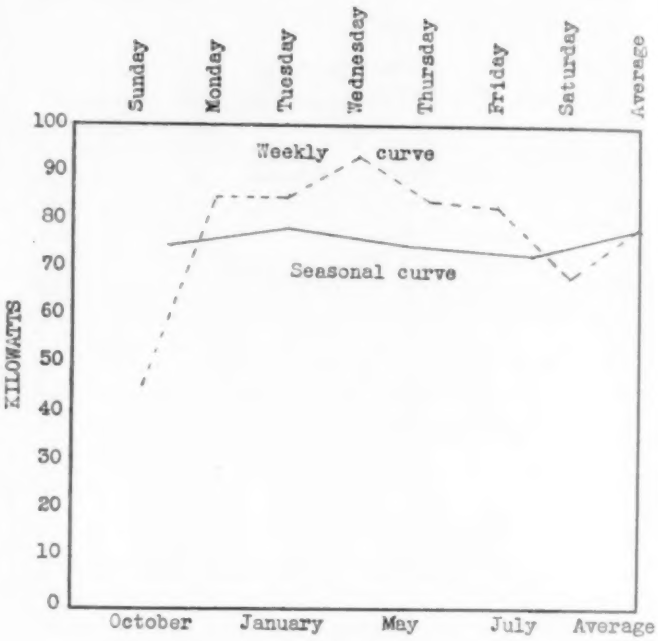


FIGURE 2

Average curves of kilowatt hour load on the master meter for four typical weeks, Colorado State College of Education, 1939-1940 and 1940-1941

details of the table will not be given here. The bills range from $1,472.54 for the largest building, which houses the laboratory schools, to $29.52 for a small home economics practice cottage.

A better approach to the development of individual responsibility in the use of college lights is illustrated in the accompanying graphs (Figures 1 and 2). Here, the daily, the weekly, and seasonal curves of use are shown, in terms of kilowatt hour load on the master meter. It is easy for faculty members and students to see in Figure 1 that there is continuous 24-hour use of electric light on the campus. The low point in the curve is found early in the morning after midnight. After a rise to the peak about 11 A.M., this level is more or less maintained until about 6 P.M., with a drop after the lunch period.

The average readings for typical weeks are shown in Figure 2. Wednesday seems to be the peak day, with the low points of the curve on Sunday and Saturday. This means that the most influential determining factor in meter reading is classroom and laboratory use. The seasonal curve seems to have its zenith during the long dark days and its nadir in the summer months. However, the detailed tables, on which the figure is based, show for one of the years of the survey a distinct rise of the seasonal curve during the months of the summer session. Then, the student body was largest and more college space was in use.

This detailed fourteen-year survey and evaluation serves the purpose of illustrating good methods of checking the use of electric light and power in higher education. The value to the college administration and the controller's office of careful time-series checks of this sort cannot be over-emphasized. It is by means of a detailed knowledge of trends in the monthly and annual status of many of the factors involved that the management is able to make wise decisions.[2] A lesson can be learned here from business practice. "Statistical control is a method of arriving at executive decisions through analysis of the facts which relate to a particular business. . . . there is rarely even a minor executive in any business who does not knowingly or otherwise, base his decisions very largely upon the statistics of his operations."[3]

The use of factual series of academic data by presidents and deans is almost universal, but on every campus it is equally desirable that trends derived from the physical basis of instruction be determined and used by those responsible. No doubt there can be improvement in this attitude and practice, even among college controllers and superintendents of buildings and grounds. Further, it has been shown that such analyses as those of steam production and cost, and the use and the bill for electric light and power can be put into form, so that the non-technical educator can understand them. This makes it more nearly possible for him to discharge his responsibility to the state for extreme care in the use of public funds. Obviously, this attitude toward economy is rapidly becoming more imperative in the present war emergency.

[2] F. L. Whitney, "An Administration Trend Book," *Journal of Higher Education*, Vol. 12, May, 1941.

[3] M. C. Rorty, "The Statistical Control of Business Activities," *Harvard Business Review*, Vol. 1, January, 1923.

MECHANICAL AND ELECTRICAL ENGINEERING CONSULTANTS

The following directory is restricted to Mechanical and Electrical Engineering Consultants who are in independent profes sional practice and have actually been identified with a number of university or school projects.

Space limitations permit only three listings for each individual or firm and preclude mentioning the name of the architect associated. The following abbreviations are used throughout: h (heating), v (ventilating), p (plumbing), ac (air conditioning), e (electrical), l (lighting), m (mechanical), pp (power plant).

CALIFORNIA

R. D. Van Alstine, 3940 Myrtle Ave., Long Beach

J. H. Davis, Ocean Center Bldg., Long Beach

E. L. Ellingwood Co., 124 W. 4th St., Los Angeles
University of Arizona, Tucson (*h, v, ac, e, m, sewage disposal, water systems*)
University of Southern California, Los Angeles (*h, v, ac, e, m, sewage disposal, water systems*)
University of Redlands, Redlands (*h, v, ac, e, m, sewage disposal, water systems*)

Ralph E. Phillips, 816 W. Fifth St., Los Angeles
Allan Hancock Foundation for Biological Research, University of Southern California, Los Angeles (*h, v, p, e, ac*)
School of Architecture and Fine Arts, University of Southern California, Los Angeles (*h, v, p, e, ac*)
Doheny Memorial Library, University of Southern California, Los Angeles (*h, v, p, e, ac*)

Robt. M. Storms, 1717 N. Vine St., Los Angeles
Ruth Reid and Barbara Worth Elementary Schools, Brawley (*p, h, v*)
Elementary and High School Buildings, Trona (*p, h, v*)
Grove Avenue School, Clearwater (*p, and water supply*)

Clyde E. Bentley, 216 Pine St., San Francisco

Thomas B. Hunter, 41 Sutter St., San Francisco
Hoover War Library, Stanford University (*h, v, ac, p, e*)
Administration, Medical, Physics, and Emergency Classroom Building, University of California at Berkeley (*h, v, ac, p, e*)
University of Nevada, Reno (*three buildings and power plant*)

Leland and Haley, 58 Sutter St., San Francisco
Bay Terrace Elementary School, Vallejo (*h, v, p*)
Steffan Manor Elementary School, Vallejo (*h, v, p*)
Junior High School, Vallejo (*h, v, p*)

G. M. Simonson, 625 Market St., San Francisco
Thomas Larkin School, Monterey (*e, h, v, p*)
Montclair School, Oakland (*e, h, v, p*)
Lakeview School, Oakland (*e, h, v, p*)

CONNECTICUT

Paul D. Bemis, 36 Pearl St., Hartford
Norwich Trade School, Norwich (*h, v, p, e*)
Ray Technical School, Moodus (*h, v, p, e*)
Cloonaan Junior High School, Stamford (*h, v, p, e*)

Bennett & Terry, 36 Pearl St., Hartford

Hill & Harrigan, 37 Whitney Ave., New Haven
North Haven High School, North Haven (*p, h, v*)
Stonybrook School, Stratford (*p, h, v*)
Edison School, Bridgeport (*p, h, v*)

Hubbard, Rickerd & Blakeley, 275 Orange St., New Haven (also at Boston, Mass.)
Library, Connecticut College for Women, New London (*p, h, ac, e*)
Williams Memorial School (Addition of Domestic Science Room), New London (*p, e*)
Westwood High School, Westwood, Mass. (*m*)

Herbert G. Ullman, 137 Newton Terrace, Waterbury

DELAWARE

Robert P. Schoenijahn, Industrial Trust Bldg., Wilmington
Service Building and Boiler Plant, University of Delaware, Newark (*h, v, p, e, ac, boilers and stoker installation*)
Men's Dormitory, University of Delaware, Newark (*p, h, v, e*)
Milford State School Addition, Milford (*p, h, v, e*)

DISTRICT OF COLUMBIA

M. F. Hoppe, 1021—20th St., N. W., Washington, D. C.
Takoma Park Junior High School Addition, Takoma Park, Md. (*h, v, p, e, ac*)
Washington Missionary College, Takoma Park, Md. (*pp, underground steam distribution, etc.*)
Franciscan Monastery, Washington, D. C. (*h, v, p, e, ac*)

Wm. K. Karsunky, 1223 Connecticut Ave., N. W., Washington, D. C.
Richard Montgomery High School, Rockville, Md. (*cafeteria and shop, h, p, e*)
Bradley Hills Elementary School, Bradley Hills, Md. (*h*)
Curley Hall, Catholic University of America, Washington, D. C. (*h, p, e*)

Weschler & Cleary, 1 Du Pont Circle, Washington, D. C.
Trinity College Science Bldg., Washington, D. C. (*h, v, p, e*)
Kingsman School, Washington, D. C. (*h, v, p, e*)
Officers School, U. S. Marine Corps, Quantico, Va. (*h, v, p, e*)

FLORIDA

John C. Pastor, 1091 Talbot Ave., Jacksonville
Seabreeze High School, Board of Education, Volusia City, Daytona Beach (*m, p, h, v*)
San Jose High School, Board of Education, Duval County, Jacksonville (*m, p, h, v*)
Vocational School and Shop, Board of Education, Duval County, Jacksonville (*m, p, h, v, water system*)

Maurice H. Connell & Associates, Langford Bldg., Miami
Rollins College, Winter Park (*m, e, sewers and equipment*)
North Beach School, South Beach School, Miami Senior High School, Dade County (*m, e, and equipment*)

GEORGIA

W. A. Mathis, Athens

Newcomb & Boyd, Trust Co. of Georgia Bldg., Atlanta
Classroom Bldg., University of Georgia, Athens (*h, v, p, e*)
Girls' Dormitory, Mercer University, Macon (*h, v, p, e*)
Auditorium, University of Georgia, Athens (*h, v, p, e*)

ILLINOIS

Irving E. Brooke, 189 W. Madison St., Chicago
Elgin Academy, Elgin (*h, p, v, wiring, refrig.*)
Central School, Harvard (*h, v, wiring*)
St. Procopius College Chemistry Bldg., Lisle (*h, p, v, wiring*)

Joseph L. Fatz, Bd. of Education, Rm. 536—228 N. LaSalle St., Chicago
Washburne Trade School, Chicago (*h, v, p, power, dust collection*)
South Side Trade School, Chicago (*dust collection*)
Wilson Junior College, Chicago (*h, v, p, power, acoustics*)

E. R. Gritschke, 123 West Madison St., Chicago

Robert E. Hattis, 141 West Jackson Blvd., Chicago
Sterling Township High School, Sterling (*h, v, p, wiring*)
Arlington Heights South School, Arlington Heights (*h, v, p, wiring*)
Avoca School, Wilmette (*h, v, p, wiring*)

E. P. Heckel & Associates, 407 So. Dearborn St., Chicago

John Howatt, Board of Education, 228 N. LaSalle St., Chicago
Lane Technical High School (*h, v, p*)
South Side Vocational High School (*h, v, p*)
Oakenwald Elementary School (*h, v, p*)

George W. Hubbard, Railway Exchange Bldg., Chicago
Notre Dame High School, Chicago (*h, p, v*)
St. Leo's High School Addition, Chicago (*h, p, v*)
St. Mary of the Lake Seminary, Mundelein (*h, p, e, pp, etc.*)

A. C. King, 35 S. Dearborn St., Chicago
Lake Forest College, Lake Forest (*h*)

Samuel R. Lewis, 407 S. Dearborn St., Chicago
McKinley High School, Columbus, Ohio (*h, v, p, e*)
University of Illinois, Urbana (*h, v, ac*)
MacCumber High School, Toledo, Ohio (*h, v*)

Neiler, Rich & Co., 431 S. Dearborn St., Chicago
New Trier Township High School, Winnetka (*consultant on pp and all buildings*)
Northwestern University, Evanston and Chicago (*h, v, e, refrig., elevators, drinking water system, hot water piping*)
University of Chicago, Chicago (*h, v, p, e, ac, elevators, refrigeration*)

Beling Engineering Company, State Trust Bldg., Moline (also in Peoria)
High School, Washington (*h, v*)
High School, Atchison, (*h, p, e*)
High School, Paris, (*h, v*)

S. Alan Baird, 41 West Melbourne St., Peoria
Addition to Grade School, Rantoul (*h, v, p, e*)
Addition to Leyden Community High School, Franklin Park (*h, v, p, e*)
High School Building, Flanagan (*h, v, p, e*)

INDIANA

R. W. Noland, 3709 Shady Court, Fort Wayne
Grade and High School, Berne (*h, v, p, e*)
German Township School, Bremen (*h, v, p, e*)
Boiler Plant, Huntington Public Schools (*entire project*)

Bevington-Williams, Inc., K. of P. Bldg., Indianapolis
School of Business, Indiana University, Bloomington (*h, v, p, e*)
Hall of Music, Indiana University, Bloomington (*h, v, ac, p, e*)
John H. Harrison Hall, DePauw University, Greencastle (*h, v, ac, p, e*)

J. M. Rotz Engineering Co., Merchants Bank Bldg., Indianapolis
Thomas Carr Howe High School, Indianapolis (*m*)
Indiana Boys' School, Plainfield (*m, power house remodeling, and service tunnel*)
Central Heating Plant and Washington Junior High School, Kokomo (*h, p, e*)

G. M. Williams, 333 N. Pennsylvania St., Indianapolis
Medical Building, Indiana University, Bloomington (*h, v, p, e*)
Physical Science Building, Indiana University, Bloomington (*h, v, p, e*)
Hall of Music, Indiana University, Bloomington (*h, v, p, e*)

IOWA

Cullen & Bartels, Stampfer Bldg., Dubuque
Washington School (remodeling) (*h, v*)
West Junior High School (remodeling) (*h, v, p*)
Ft. Des Moines School (*h, v, sewage disposal*)

B. E. Landes, Hubbell Building, Des Moines
Agricultural Engineering Laboratory, Iowa State College, Ames (*h, v, p, e*)
Three Grade Schools, Ottumwa (*h, v, p, e*)
Women's Gymnasium, Iowa State College, Ames (*h, v, p, e*)

Meryl L. Todd & Associates, 1111 Independence Ave., Waterloo
High School and Gymnasium-Auditorium, Laurens (*h, v, p, pp*)
High School Gymnasium-Auditorium Addition, Webster City (*h, v, p*)
High School and Gymnasium-Auditorium, Harcourt (*h, v, p, pp*)

LOUISIANA

L. Villere Cressy & Lewis S. Alcus, 916 Union St., New Orleans
Pan American House, Louisiana State University, University (*p, h, e*)
Biloxi High School, Biloxi, Miss. (*p, h, e*)

MARYLAND

Perring & Remington, 10 West Chase St., Baltimore

MASSACHUSETTS

G. K. Saurwein, 247 Slade St., Belmont
Harvard Medical School Power Plant, Boston (*entire project*)
Harvard University, Cambridge (*fire protection, h, v, ac, e, steam distribution underground systems*)
New England Conservatory of Music, Boston (*automatic h control, pp problems*)

Hollis French, Office of, 210 South St., Boston
Auditorium, Rhode Island School of Design, Providence (*h, v, ac, p, l, pp*)
Groton School, Groton (*extensive underground steam distribution system*)
St. Mark's School, Southboro (*new sewage filter beds*)

Hubbard, Rickerd & Blakeley, 110 State St., Boston (also at New Haven, Conn.)
Westwood High School, Westwood (*h, v, p, e*)
High St. School, Medway (*h, v, p, e*)
School, Medway (*h, v, p, e*)

Richard D. Kimball Co., 6 Beacon St., Boston

William A. McPherson, 86 Dwinell st., Boston
F. V. Thompson School (*h, v*)
Airplane and Technical Shops, Boys' Trade Group (*h, v*)
Addition to Michael Perkins School (*h, v*)

Frederick D. B. Ingalls, 1 Hopkins St., Boston
Engineering Bldg. of Worcester Polytech. Inst. (*h, v*)

MICHIGAN

J. N. Hadjisky, 744 Bates St., Birmingham
Michigan Normal College, Girls' Dormitory, Ypsilanti (*h, v, p*)
Barnum School, Birmingham (*swimming pool operation*)

Farrell & White, 409 Griswold St., Detroit
Ford Elementary School, Detroit (*m*)
Mumford High School, Detroit (*p, h, v, e*)
Addition to Wayne University, Detroit (*p, h, v, e*)

N. B. Hubbard, 220 Bagley Ave., Detroit
Addition, East Jordan (Mich.) High School (*h, p, e*)
Service Bldg., State School for Deaf, Flint (*h, p, e*)
Addition to Columbus School, Detroit (*h, p, v*)

Snyder & McLean, Penobscot Building, Detroit
High School, Alpena (*h, v, p, e, m*)
Dramatic Arts Building, Western State Teachers College, Kalamazoo (*h, v, p, e, stage equipment*)
Chemical Engineering Building, Michigan College of Mining Technology, Houghton (*h, v, p, e, m*)

Ray S. M. Wilde, 18286 Griggs St., Detroit
Cranbrook School for Boys, Bloomfield Hills (*m, e*)
Kingswood School for Girls, Bloomfield Hills (*m, e*)
Michigan Union Dormitory, Ann Arbor (*m, e*)

MINNESOTA

Charles Foster, Medical Arts Building, Duluth
Ondossagon Gym Addition, Ashland, Wis. (*h, v, p, e*)
Remer School Addition, Remer (*h, v, p, e*)
State Teachers College, Duluth (*h, v, p, e*)

Ralph L. Bloom, Sexton Bldg., Minneapolis
Auditorium and Classroom Addition, High School, Osakis (*h, v, p, e*)
School Addition, Waite Park
Auditorium, Washington High School, Fergus Falls (*h, v, p, e*)

A. D. Martino, Metropolitan Life Bldg., Minneapolis
St. Mark's School, Shakopee (*p, h, e*)
Sisters of St. Francis School, Convent, and Chapel, Little Falls (*p, h, v, e*)
Resurrection School, Minneapolis (*p, h, v, e*)

G. M. Orr & Company, Farmers and Mechanics Bank, Minneapolis.
State Teachers College, Physical Education Building, Mankato
Central School, Rochester
Mound School, Mound

Rose & Harris, Essex Bldg., Minneapolis
Library Building, Macalester College, St. Paul (*h, v, p, e, sewer*)
Miller Vocational School, Minneapolis (*m*)
Library, St. Olaf College, Northfield (*m*)

A. L. Sanford, Empire Bank Building, St. Paul
Wallace Hall Dormitory, Macalester College, St. Paul (*h, v, p, e*)
High School, Bloomington (*h, v, p, e, t.c., boiler plant*)
Public Schools, Minneapolis (*h, v, p, e, t.c., elevators, pp*)

MISSOURI

William L. Cassell, 912 Baltimore Ave., Kansas City

Nate W. Downes, 1840 E. 8th St., Kansas City

Gilham & Meyers, 337 Law Bldg., Kansas City
Buildings for the University of Arkansas, Fayetteville (*h, v, p, e*)
Home Economics Bldg., University of Nebraska, Lincoln (*m*)
Boys' Dormitory, Curtis, Nebr. (*m*)

John D. Falvey, 316 N. 8th St., St. Louis
Culver Military Academy, Culver, Ind. (*pp, m*)
Chemistry Building, Missouri School of Mines, University of Missouri, Rolla (*h, v, p, e*)
Lanphier High School, Springfield, Ill. (*h, v, e, p*)

Will D. Sampson & Associates, Ambassador Bldg., St. Louis
Six buildings, University of Texas, Austin (*h, v, p, e*)
Six buildings, Texas State College for Women, Denton (*m*)
East Texas Teachers College, Commerce

A. H. Vogel, 6134 Tennessee Ave., St. Louis

NEBRASKA

H. S. Seymour, World-Herald Bldg., Omaha
Religious Education Building, Dundee Presbyterian Church, Omaha (*h, v, p, e*)
Addition, Alta Vista Ward School, Cheyenne, Wyo. (*h, v, p, e*)
Women's Residence Hall, University of Wyoming, Laramie, Wyo. (*h, v, p, e*)

NEW JERSEY

Perring & Remington, 509 Cooper St., Camden

Abraham Walton, 92 Highland Ave., Jersey City

Runyon & Carey, 33 Fulton St., Newark
Bloomfield (N. J.) Junior High School (*h, v, p, e*)
Katonah (N. Y.) Junior High School (*h, v, p, e*)
Connecticut Farms School, Union Township (*h, v, p, e*)

NEW YORK

George A. Teeling, 1 Columbia Place, Albany
Cayuga Union School, Cayuga (*sewage disposal system*)
Sillman Hall, Union College, Schenectady (*h, v*)
St. Patrick's School, Troy (*h*)

Thomas F. Dwyer, Board of Education, 49 Flatbush Ave. Ext., Brooklyn, N. Y.
Ft. Hamilton High School (*h, v, ac*)
Benjamin Franklin High School (*h, v, ac*)
Machine & Metal Trade High School (*h, v, ac, m*)

Beman & Candee, 374 Delaware Ave., Buffalo
Kenmore Senior High School, Kenmore (*h, v, p, e, swimming pool*)
Brocton Central Grade and High School, Brocton (*h, v, p, e, sanitation*)
Clark Memorial Gymnasium, University of Buffalo (*h, v, p, e, steam tunnel*)

Edward E. Ashley, 10 E. 40th St., New York
Library Extension, Sterling Hall of Medicine, Yale University, New Haven, Conn. (*p*)

Clark, MacMullen & Riley, Inc., 101 Park Ave., New York

Victor J. Cucci, 30 Church St., New York
Chapel, Skidmore College, Saratoga Springs (*h, v*)
Laboratory, St. Lawrence University, Canton (*p, sanitation*)
Science Building, Hampton Institute, Hampton, Va. (*h, v*)

Albert Fentzlaff, Inc., 11 W. 42nd St., New York
Suffern High School, Suffern (*p, h, v*)
Riverhead High School, Riverhead (*p, h, v*)
Great Neck High School, Great Neck (*p, h, v*)

Jaros, Baum & Bolles, 415 Lexington Ave., New York
Monroe Hall, Middlebury College, Middlebury, Vt. (*h, v, p*)
Gifford Hall, Middlebury College, Middlebury, Vt. (*h, v, p*)
St. Helena's Parish, Wilmington, Del. (*h, v, p*)

Dwight D. Kimball, 1728 Grand Central Bldg., New York

Krey and Hunt, 292 Madison Ave., New York
Brentwood School, Brentwood (*p, e, h, v*)
Mt. Vernon Seminary, Washington, D. C. (*p, h*)
Classroom Building, Clark College, Atlanta, Ga. (*e*)

Lockwood Green, Inc., 10 Rockefeller Plaza (also Montgomery Bldg., Spartanburg, S. C.)

William McClintock, 4116 Carpenter Ave., New York
Monroe High School, New York (*p and swimming pool*)
Public School 89, Brooklyn (*p, h, v*)
Public School 165, New York (*p*)

Alfred J. Offner, 139 East 53rd St., New York
Hotchkiss School, Lakeville, Conn. (*h, v*)
Lawrenceville School, Lawrenceville, Conn. (*h, v*)
New Canaan Country School, New Canaan, Conn. (*h, v*)

Sullivan A. S. Portorno, 101 Park Ave., New York

Clyde R. Place, 420 Lexington Ave., New York

Slocum & Fuller, 18 E. 41st St., New York
Grover Cleveland Junior High School, Elizabeth, N. J. (*h, v, e, and sanitary work*)
Cranford High School, Cranford, N. J. (*h, v, e, and sanitary work*)
Center Street School, Norwalk, Conn. (*h, v, e, and sanitary work*)

Frank Sutton, 149 Broadway, New York
Gymnasium, Rutgers University, New Brunswick, N. J. (*h, v, e*)
Schermerhorn and Physics Building, John Jay Hall, Columbia University, New York (*h, v*)
Alfred University, Alfred (*boiler plant and controlled heating*)

Syska & Hennessy, 144 E. 39th St., New York
Cardinal Hayes Memorial High School for Boys, New York (*h, v, e, incinerators and sanitary work*)
University of North Carolina Chemistry Building, Chapel Hill (*h, v, p, e, elevators*)
Hillside High School, Hillside N. J. (*h, v, p, e*)

Paul Wunderlich, Grand Central Terminal Bldg., New York
Science Bldg., St. Patrick's School, Troy (*h, p, e, v*)
Shaler Hall and Fisher Museum, Wheaton College, Norton, Mass. (*h, p, e*)
Harvard Forest, Petersham, Mass. (*h, p, e*)

Stanley C. Stacy, Board of Education, 13 South Fitzhugh St., Rochester
John Marshall High School (*h, v, p, e*)
Edison Technical & Industrial High School (*h, v, p, e*)
Junior Vocational School (*h, v, p, e*)

Harold L. Alt, 115-27 225th St., St. Albans
North Side High School, Newark, N. J. (*h, ac, v*)
Shanghai American School, Shanghai, China (*h, p, boiler plant*)
Schenley High School, Pittsburgh, Penna. (*h, v, boiler plant*)

Cedric R. Acheson, Eckel Building, Syracuse
Clayton Central School, Clayton (*h, v, e*)
Addition to High School, Cortland (*h, v, e*)
Hadley-Luzerne Central School, Luzerne (*h, v, e*)

Irwin W. Whittemore, Cannon Place, Troy
Slingerlands Grade School, Delmar (*entire project*)
Thomas A. Knickerbocker Junior High School, Lansingburgh, Troy (*entire project*)

Field, Emerson & Morgan, Inc., 20 Flower Bldg., Watertown, New York

OHIO

Wm. E. Bodenstein, 405 Second Nat'l Bank Bldg., Cincinnati

Fosdick & Hilmer, Union Trust Bldg., Cincinnati
Classroom and Laboratory Building, Miami University, Oxford (*p, h, v, e*)
Men's and Women's Dormitories, Miami University, Oxford (*h, p, v, e, refrigerators, elevator*)
Holmes High School, Covington, Ky. (*h, v, p, e, boilers, stokers, breeching*)

A. M. Kinney, Inc., Enquirer Bldg., Cincinnati
Denison University, Granville (*pp, h, p, e*)
Lincoln Grant School, Covington, Ky (*m*)
Mount Washington School, Cincinnati (*m*)

O. W. Motz, 920 E. McMillan St., Cincinnati
Addition to Chemistry Building, University of Cincinnati (*h, v, temp. control, e*)
Addition to St. John's School, Cincinnati (*h, v, p, e*)
Our Lady of Lourdes School, Indianapolis (*h, v, p, e*)

J. P. Neal, 1428 Herschel Ave., Cincinnati

Willard C. Pistler, Leverone Bldg., 4 West 7th St., Cincinnati
Branch Hill School, Branch Hill (*h, v, p, e*)
Sixth District School, Covington, Ky. (*h, p, e, v*)
Boone County School, Burlington, Ky (*h*)

John Paul Jones, Cary & Millar, 448 Terminal Tower, Cleveland
Physics Buildings, Oberlin College, Oberlin (*h, v, p, e*)
Hall Auditorium, Oberlin College, Oberlin (*h, v, p, e*)
Garfield School, Painesville (*h, v, p, e*)

OKLAHOMA

Clyde O'Dell, Claremore

OREGON

J. Donald Kroeker, Failing Bldg., Portland
Science Building, Willmette University, Salem (*h, v, p, pp*)
Sacred Heart Parish School, Oswego (*h, p*)
Warrenton High School, Warrenton (*h*)

Thomas E. Taylor, Postal Bldg., Portland
Alterations and Additions to 5 Schools, Pendleton (*h, v*)
Miscellaneous Additions, Portland (*h*)
Sunset Grade School, West Linn (*h, v*)

PENNSYLVANIA

Harry B. Joyce, Commerce Building, Erie
Lakewood School, West Millcreek (*h, v, p, e*)
State Teachers College Auditorium Building, Edinboro (*h, v, e*)
State Teachers College, Slippery Rock (*pp*)

Chas. A. Blatchley, Drexel Bldg., Philadelphia
Memorial High School, Arlington, Vt. (*h, v, p, e*)
Junior High School, Upper Darby Township, Delaware Co. (*m, e*)
North-West Junior High School, Reading (*m, e*)

Day & Zimmerman, Inc., Packard Bldg., Philadelphia

Harry J. Eggly, Jr., Architects Bldg., Philadelphia
Technical Division, Senior High School, Lower Merion School District, Ardmore (*p, h, v, boiler house*)
Junior High School, Bristol Township, Bucks Co. (*h, v*)
Library Bldg., University of Maine, Orono (*p, h, ac*)

Louis T. Klauder and Associates, Lincoln Liberty Bldg., Philadelphia
Frick Chemical Laboratory, Princeton University, Princeton, N. J. (*h, v, p, e*)
Student Alumnae Bldg., Wilson College, Chambersburg (*m, e*)
Dormitory, Wellesley College, Wellesley, Mass. (*m, e*)

Charles S. Leopold, 213 S. Broad St., Philadelphia
Temple University, Unit No. 2 (*h, v*)
Grade School, Reading (*p, h, v, e*)
Joint University Library, Vanderbilt, Scarritt, and Peabody Universities, Nashville, Tenn. (*ac, p*)

Moody & Hutchison, Architects Bldg., 17th & Sansom Sts., Philadelphia
Laboratory Bldg., University of Pennsylvania, Philadelphia (*h, v, p, e*)
Two Dormitories, U. S. Naval Academy, Annapolis (*h, v, p, e, elevators*)
Laundry Bldg., U. S. Military Academy, West Point, N. Y. (*h, v, p, e*)

Pennell and Wiltberger, Land Title Bldg., Philadelphia
Northeast Catholic High School for Girls, Philadelphia (*h, p, e*)
Bell Avenue School, Yeadon (*p*)
Bloomsburg State Teachers College, Bloomsburg (*m, including pp*)

George W. Powell, Jr., 112 S. 16th St., Philadelphia
Chester (Pa.) Vocational School (*e*)
Garretford Public School, Upper Darby Township, Delaware Co. (*p, h, v, e*)
Willistown Elementary School, Willistown Township, Chester Co. (*p, h, v, e*)

Chas. H. Speckman, 482 Bourse Bldg., Philadelphia

Arthur McGonagle, 6815 Prospect Ave., Pittsburgh
Mellon Institute, Pittsburgh (*h, v, m, laboratory equipment*)
Allegheny College, Meadville (*central steam plant*)
Ambridge High School, Ambridge (*h, v*)

Elwood S. Tower, Investment Bldg., Pittsburgh
Addition, Wellsville (Ohio) Vocational School (*h, v, p, e*)
National School, Treviskyn (*h, v*)
Neville Township School, Neville Island (*remodeling h, v*)

RHODE ISLAND

John J. McCarthy, Providence Public School Department, 20 Summer St., Providence
Hope High School (*h, v*)
Mount Pleasant High School (*h, v*)
Nathanael Greene Junior High School (*h, v*)

TENNESSEE

***George S. Campbell,** Cotton States Bldg., Nashville

TEXAS

H. W. Skinner, 4816 Dexter, Ft. Worth

R. K. Werner, W. T. Waggoner Bldg., Fort Worth
Additions to Dunbar, Travis, Houston, Barber Elementary Schools and to High School, Mineral Wells (*m, e*)
Senior High School, Mineral Wells (*m, e*)
Journalism Bldg., Texas State College for Women, Denton (*m, e*)

Dale S. Cooper, 216 E. Cowan Drive, Houston
St. Agnes School for Girls, Houston (*m, e, h, v*)
High School, Luling (*h, v*)

Robert J. Cummins, 1027 Bankers Mortgage Bldg.

Taylor & Bible, Bankers Mortgage Bldg.

VIRGINIA

Chas. R. Ammerman, 605 Upland Place, Alexandria

Wiley & Wilson, Peoples Bank Bldg., Lynchburg
High School, Charlottesville (*h, v*)
Colored Elementary School, Lynchburg (*h, v*)
Gymnasium, University of North Carolina, Chapel Hill (*h, v*)

WASHINGTON

Lincoln Bouillon, 1411 Fourth Ave. Building, Seattle
J. M. Perry Institute of Trades, Industries, Agriculture, Yakima (*m, e*)
The Dalles High School, The Dalles (*h, v, p, e*)
Campus Elementary School, Western Washington College of Education, Bellingham (*h, v, p, e*)

Griffin & Lowe, Lloyd Bldg., Seattle
School, Bellevue (*h, v, p, e*)
School, Port Orchard (*h, v, p, e*)

C. W. May, Smith Tower, Seattle
Wallace School, Kelso (*h, v, p, e, ac*)
College of Puget Sound Women's Dormitory, Tacoma (*h, v, p, e, ac*)
Chemistry and Science Building, Washington State College, Pullman (*h, v, p, e, ac*)

Erwin L. Weber, Medical Arts Bldg., Seattle
Grade School, Silverdale (*h, v, p, e, ac*)
Navy Yard City and Lulu Haddon Schools, Bremerton (*h, v, p, e, ac*)
Shops, High School, Clover Park (*h, v, ac, p, e*)

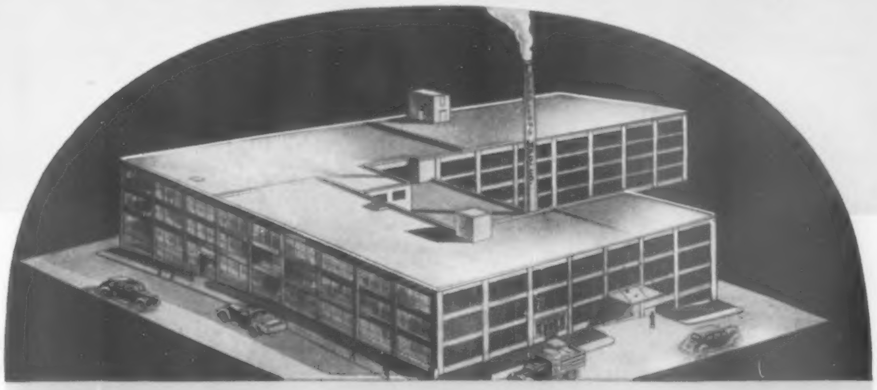
C. G. Zokelt, 3810 24th Ave. South, Seattle
Anchorage Grade School and High School Additions, Anchorage, Alaska (*h, v, p, e*)
Longview Grade and High School Additions, Longview (*h, v, p*)
Mount Vernon Grade School, Mount Vernon (*h, v*)

WISCONSIN

G. L. Larson, 1213 Sweetbriar Road, Madison
Biochemistry Building, University of Wisconsin, Madison (*h, v, ac*)
Adams, Roosevelt and Washington Schools, Janesville (*h, v*)
Lapham and Marquette Schools, Madison (*h, v*)

* In Service

J. I. HOLCOMB MFG. COMPANY.



BUILDERS OF TOOLS WHICH CLEAN THE NATION

The J. I. Holcomb Mfg. Company produces approximately 500 products to help keep schools, hospitals, institutions and all types of buildings clean and sanitary from boiler room to sun deck. The best of materials from the world over are brought to "Cleaning Headquarters" to go into the construction of quality merchandise. These daily cleaning tools and materials are built for one purpose . . . to do a *good* job FASTER. By speeding up the job and saving on maintenance time, each Holcomb tool and chemical makes a new yearly profit for you, the user.

1896 **1943**

General Office

Part of Floor Brush Production Line

Holcomb tools work faster . . . clean more thoroughly the first time over . . . make money by cutting maintenance time.

If your Holcomb tool saves only one hour of cleaning time each day, that is a new profit of $156.00 a year . . . on each man, (at only 50c an hour).

Chemical Laboratory

Part of Chemical Wing

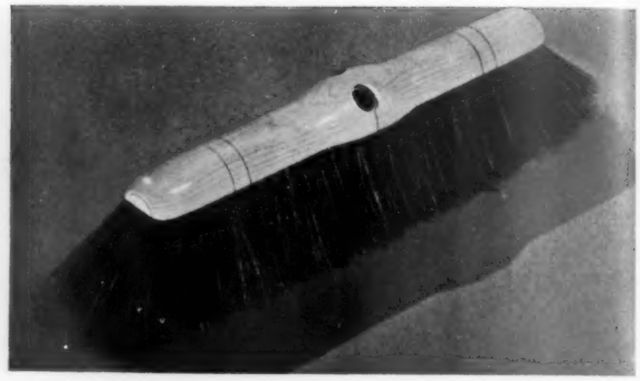
J. I. HOLCOMB MFG. CO. *"Cleaning Headquarters"* **INDIANAPOLIS–NEW YORK**

Holcomb's FAST Sweepers!

The UNIVERSAL

. . . For Smooth and Medium Floors

The Universal stock is a scientific blend of "proved on the job" bristle, extra STIFF hair and fiber. Grey in color, the stock extends 3 7/8 inches out of the block. This stock snaps soil ahead of the brush, gets it *all* in one stroke. For smooth and medium floors; it comes in 12-14-16-18 and 24 inch sizes. 5 1/2 ft. handles included.



The MEMPHIS

. . . For Various Soils on Different Surfaces

Designed years ago for Memphis Schools, this school sweeper does a marvelous job in sweeping various soils on different floor surfaces. Stock is a perfectly blended mixture of bristle, hair and fiber. An aggressive center for coarse soil and an outer casing of hair and bristle for the fine dirt. Sizes 12-14-16-18 and 24 inches. Handles included.

The PILOT

. . . For a Variety of Floor Surfaces

The Pilot stock, grey in color, is full of snap, life and aggressive dirt moving bristle and hair. Stock extends 3 7/8 inches out of block. Full flared ends get the corners. Sizes are 12-14-16-18 and 24 inches. Use the Pilot for FASTER sweeping where there is a variety of floor surfaces under one roof. Handles included.

The RACER

. . . For Medium and Smooth Floor Surfaces

This sweeper has a center of mixed grey hair and fiber and an outer casing of all HAIR. The outer casing of extra stiff, selected horse hair snaps the finer dust ahead of the brush. It's Full of *Snap*, *Vigor* and *Life*. Stock trimmed 3 1/8 inches out of block. Has a 2 inch sweeping flare at each end. Sizes 14-16-18-24 inch blocks. Handles included.

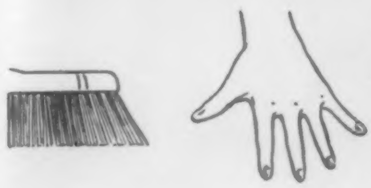
J. I. HOLCOMB MFG. CO. *"Cleaning Headquarters"* **INDIANAPOLIS-NEW YORK**

"uilt to Do a GOOD job FASTER!"

1.

It's the "LIFE" Built into the Brush that Counts

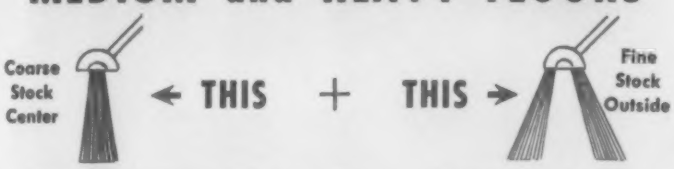
2.



Spread your fingers. That's the way end flair is "Built in" a Holcomb Sweeper.

3. Sweeper Stocks Correctly *Arranged* for

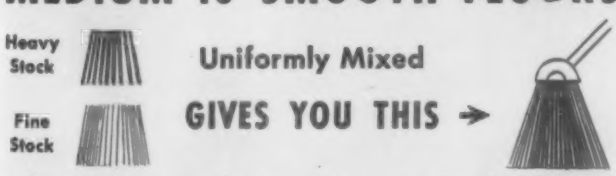
MEDIUM and HEAVY FLOORS



for Coarse and Fine Dirt on Rougher Floors

4. Sweeper Stocks Correctly *Blended* for

MEDIUM to SMOOTH FLOORS



for Coarse and Fine Dirt on Smooth Floors

There is a Holcomb floor sweeper with either correctly *ARRANGED* stock or scientifically *BLENDED* stock FOR EVERY TYPE of floor surface and for EVERY KIND of DIRT! The CORRECT sweeper for your floor SWEEPS the dirt it's built for *FASTER* and with LESS *EFFORT*.

Holcomb

FLOOR SWEEPERS

Holcomb sweepers have been built according to the specifications of the men who use them. Over 40 years of sweeping experience has developed this famous line.

- Correct handle angle and height of handle gives longer sweeping stroke.
- Correct handle angle keeps brush face *flat* on the floor the full length of the stroke.
- Threaded staff holes "lock" block to the handle; does not slow worker by pulling out.
- Holcomb sweepers retain their aggressive "spring" and "snap". They do not break down.
- Correctly fitted to your floor surface and kinds of soil, they *MOVE ALL THE DIRT with ONE STROKE.*

Tell the HOLCOMBMAN your floor sweeping problem and he'll *RECOMMEND* a sweeper which will MAKE YOU MONEY by *cutting LABOR TIME*. Save 1 sweeping hour each day (labor at 50c an hour) and you have made

A NEW YEARLY TIME PROFIT OF

$156.00

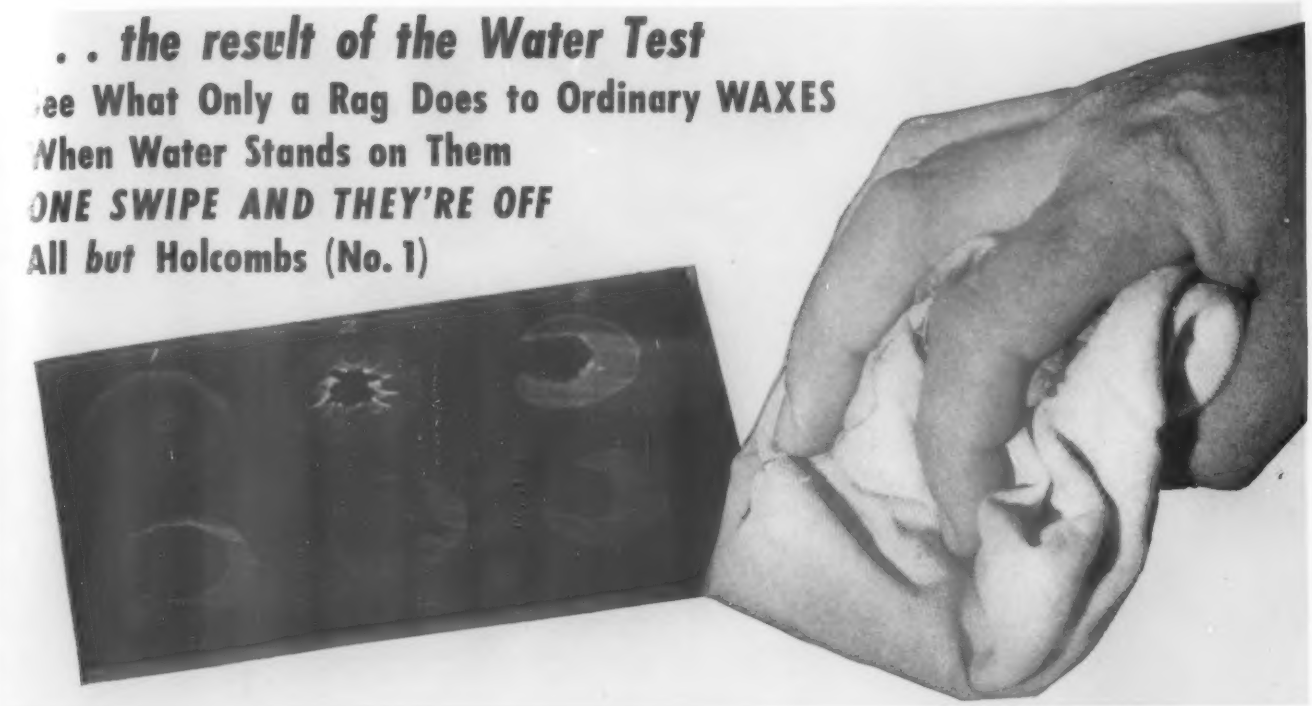
They Sweep **CLEAN** *Faster!*

That Means **DOLLARS** *in Your Pocket*

J. I. HOLCOMB MFG. CO. *"Cleaning Headquarters"* INDIANAPOLIS-NEW YORK

. . the result of the Water Test

ee What Only a Rag Does to Ordinary WAXES
Vhen Water Stands on Them
ONE SWIPE AND THEY'RE OFF
All *but* Holcombs (No. 1)



Holcomb WATER-PROOF WAX LASTS LONGER

Even Where Wet and Muddy Feet Daily Track Up School Floors!

By lasting longer under heaviest traffic, Water-Proof Wax reduces number of applications. It saves *time* on floor waxing and eliminates polishing. Cut maintenance TIME and you cut maintenance costs. On school floors where wax wears off quickly in traffic lanes, use Holcomb Water-Proof Wax. IT PATCHES PERFECTLY, LASTS LONGER! Wax is cheaper than new floors, especially in war time. Use *HOLCOMB* WATER-PROOF WAX and cut number of waxings a year.

HOLCOMB CLEANING TOOLS AND CHEMICALS . . . Built to do a Good Job FASTER

Holcomb No. 414 JUMBO DUSTLESS SWEEPER

- ***It is Faster — Noiseless***
- ***It Polishes as it Dusts***
- ***Its Soft Strands Hold More Dirt***
- ***It Makes YOU a New Yearly Profit by cutting Cleaning Time***

Jumbo Dustless Sweeper glides smoothly, swiftly, silently over school rooms and corridors, its thousands of soft, absorbent yarn strands picking up more dirt and *holding it. No* germ-laden *dust is raised* . . . no sound disturbs pupils. Save sweeping compound costs . . . cut dusting time because the Jumbo covers more space per stroke and polishes as it sweeps. YOU'LL CUT MAINTENANCE COSTS with the JUMBO.

RETREAT with Holcomb NU-FINISH

The No. 341 MITTEN DUSTER
For Fast Hand Dusting

Chemically treated for general dusting, the 341 Mitten Duster cuts cleaning time. Operator can wear one on each hand. Thousands of soft chemically treated strands on heavy envelope. Easily washed. Easily re-treated with NU-FINISH.

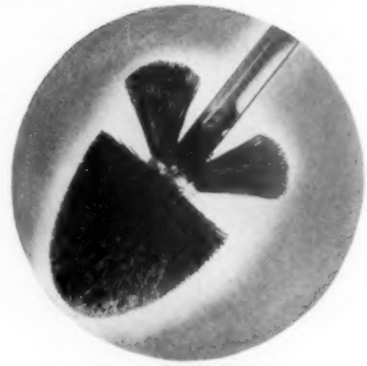
J. I. HOLCOMB MFG. CO. *"Cleaning Headquarters"* **INDIANAPOLIS-NEW YORK**

Schools the Nation Over Cut Costs- Keep Clean - Safeguard HEALTH with these TIME SAVING Items


No. 15 MOP

Holcomb No. 15 MOP

With help scarce . . . save one man's time with Holcomb's No. 15 Mop. Highly absorbent yarn saves trips to mop bucket, holds more water, picks up more mopping solution. That time saved is money earned! 16-20-24-32 oz. heads.


No. 6 TOILET BRUSH

Holcomb No. 6 TOILET BRUSH

Safeguard pupils' health—remove germ laden scum from under toilet bowl rim with the stiff wings of No. 6. "Built on the handle," one twist of the wrist cleans bowl and under the rim. ***No. 6;*** brush part 6", diameter 4", end 2". ***No. 26*** for bowls with smaller openings.

Holcomb No. 66 SCRUBBER

A speedy, dirt digging scrubber that gets all the soil from smooth and medium rough floors, wet or dry, the FIRST time over. The 66 digs out embedded dirt in halls, assembly rooms FAST . . . cuts scrubbing time. ***No. 44,*** face 3¾" x 9½"; ***No. 66,*** face 3¾" x 13½"; ***No. 88,*** face 3¾" x 17½".


No. 66 SCRUBBER


BOWL CLEANER

Holcomb BOWL CLEANER

Keep toilet bowls clean and odorless . . . use Bowl Cleaner twice a week for ***constant sanitation.*** Easy to use, it acts at once. In 40-75-175 lb. pails and 6-12-24 cans to carton.

STOP-GO . . . Save time and inconvenience . . . open that clogged drain in a few minutes! Stop-Go dissolves, loosens foreign matter without damage to plumbing. 6-12 cans to carton, 25-50-100 lb. pails.

Holcomb DEFENSE LIQUID SOAP

Helps prevent chapped, cracked hands because it's ***good*** for the skin. Gets children's hands ***thoroughly*** clean . . . is ***economical*** to use . . . a few drops go farther. Schools everywhere are adopting pure, neutral "Defense" Liquid Soap. In 5-15-30-55 gal. drums.


LIQUID SOAPS

Holcomb ODOR BLOCKS

Quickly replaces stale, musty odors in locker rooms and all rooms with little air circulation. Regulate pleasant, faint rose scent by removal of waxed paper. Attractive metal cage furnished.


ODOR BLOCKS

FRESHETTES:

A one-purpose deodorant for urinals . . . replaces odors with slight fragrance. Does not have that "rest room" odor. Freshettes are compact, economical, long lasting. 6 to a can, 4 and 12 cans to carton.

J. I. HOLCOMB MFG. CO. *"Cleaning Headquarters"* **INDIANAPOLIS-NEW YORK**

Holcomb **Puritine's**

3 *Scientifically Fused Cleaning Ingredients*

The Dirt and Grease Solvent

The Free Rinsing Agent

The Water Softener

Puritine Makes YOU Money by Cleaning Faster, Easier and by Going 3 Times as Far as the Ordinary Cleaner.

What Is It?

Puritine, composed of tiny white crystals that are completely soluble, is a 100% active dirt and grease solvent that is effective in hot or cold water.

What Does It Do?

Puritine makes the hardest water "soft as velvet" and removes dirt, grease and grime from any surface. Rinses freely, leaving no film.

How Far Does It Go?

The SPEED and thoroughness of Puritine as a grease solvent, dirt remover and water solvent make it go almost three times as far as ordinary cleaning compounds. A little goes a long way! It costs only a penny a pail.

How Quickly Does It Act?

Puritine is a chemical combination that is instantaneously soluble in either hot or cold water. As it is 100% active and 100% soluble, it acts immediately—RIGHT NOW.

It Does NOT Contain . . .

. . . Soap which leaves a film to catch and hold dust . . . or to leave a dangerous slippery film on floors.

. . . Caustic or soda ash which endanger the operator.

. . . Filler, sand or abrasive to scratch or harm the surface cleaned.

J. I. HOLCOMB MFG. CO. *"Cleaning Headquarters"* **INDIANAPOLIS-NEW YORK**

Special Holcomb SCHOOL ITEMS

VITALIZED CLEANING COMPOUND

Wash floors, walls, woodwork, desks FAST . . . V.C.C. penetrates and *floats off* dirt and grease. Practically eliminates scrubbing . . . cannot injure any surface water will not harm. Speedy cleaning saves time and money and . . . V.C.C. IS SPEEDY! In 5-15-30-55 gal. drums.

FORM-AL SPRAY. . . Many Boards of Health recommend formaldehyde disinfecting. Form-Al disinfects with positive action of formaldehyde and deodorizes with pleasing aroma. IT'S EFFECTIVE! In 5-15-30-55 gal. drums—1 gal. cans.

WINDOW CLEANER

Spray on—Wipe off—4 times as fast! Windows sparkle and stay clean longer. No film. One hour saved each day means $156.00 a year! (Labor 50c hour.) Holcomb Window Cleaner is NON-INFLAMMABLE! Handy spray bottle furnished. In 1 gallon bottles or 6 to a case.

INSEKILL . . . DESTROY PESTS . . . effective, fast acting Insekil does the job on roaches, flies, all insects. Safe for cafeterias. The pleasant smelling liquid spray is harmless to warm blooded animals. In 5-15-30-55 gal. drums—1 gal. cans.

WHITE STREAK

This Quick-as-a-Flash Holcomb cleanser cleans so easily, harmlessly and thoroughly that repainting is often unnecessary for years. Painted walls and furniture . . . woodwork, floors . . . porcelain, tile, enamel and granite . . . all are cleaned rapidly and no soap film remains. In 25-80 lb. pails—275 lb. bbls.

FUNGICIDE . . . KILLS FUNGUS THAT CAUSES "ATHLETE'S FOOT"! Does not bleach, stain or irritate . . . is stable and odorless. Use in foot baths in showers, pools, locker rooms and spray on floors. In 5-15-30-55 gal. drums.

NO-MAR MOP *No Metal Can Scratch*

SPEEDS MOPPING . . . no metal can scar desks or furniture, and operator is not afraid to mop FAST. Absorbent yarn picks up more water. Mop head changed and cleaned in a jiffy—wrings all the way to the top! 16-20-24-32 oz. heads.

IF YOU HAVE A SCHOOL CLEANING PROBLEM HARD TO SOLVE . . . WRITE HOLCOMB!

J. I. HOLCOMB MFG. CO. *"Cleaning Headquarters"* **INDIANAPOLIS-NEW YORK**

WEST DISINFECTING COMPANY

42–16 West Street, Long Island City, New York

MANUFACTURERS AND DISTRIBUTORS OF

Liquid Soaps and Dispensing Systems — **Paper Towels and Cabinets** — **Disinfectants and Deodorants** — **Kotex Vending Machines** — **Insecticides and Raticides** — **Cleansers** — **Floor Finishes**

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Washington, D. C.

AND PRINCIPAL CITIES IN CANADA

HELP PROTECT INDUSTRIAL TRAINEES AGAINST OCCUPATIONAL SKIN DISEASES

LAN-O-KLEEN *

A hand cleaner of special value to manual training and industrial training classes in helping to protect against occupational skin diseases. Lan-O-Kleen is made of corn meal in which has been impregnated lanolin oil. This new product removes stubborn dirt, oils and greases and also tends to replace natural oils in the skin. Samples available for the asking.

WEST PROTECTIVE CREAMS

are an external protection to help guard workers against skin irritants which may lead to dermatitis. Consult a West specialist to determine which of the many West Protective Creams are best suited to help protect your students against the specific materials handled.

PROPER WASHROOM SANITATION IS A PRIMARY HEALTH REQUISITE

SHOWER-ROOM DISINFECTANT

An odorless disinfectant which, if used as directed, will help prevent the spread of "Athlete's Foot." Also used to disinfect *washrooms* and *locker-room floors, runways* and *diving boards*. Showersan will help maintain your *swimming pool* in a sanitary condition. A West Foot Tray, filled with a solution of Showersan should be placed in the entrance to the shower room.

LIQUID SOAPS

West Liquid Soaps are uniform and of superior quality. Made of pure vegetable oils, the finished product is treated, aged and retested several times before leaving the factory. West Liquid Soaps do not tend to irritate or dry the skin. Liquid Soap, besides being sanitary and safe, eliminates waste of partially-used cake soap which might be thrown or taken away.

DEODORANTS

An efficient method of deodorization in lavatories is the West Automatic Drip Machine. The special drip fluid spreads on the surface of the water and helps overcome bad odors at the source. However, no matter how efficient automatic deodorization may be, the daily or routine use of a cleansing disinfectant such as Coro-Noleum * on washroom floors, basins, seats, etc., is important.

DISINFECTANTS

The primary purpose of a disinfectant is to kill pathogenic organisms. For general sanitation, it is important to choose a product that combines both cleaning power and disinfecting value. This will reduce labor and material costs since two jobs are being done at one time. Coro-Noleum,* a coal tar cleansing disinfectant, Pynoco * and Comax,* Pine disinfectants, and Westamine * Spray Fluid, an odorless disinfectant, are just a few of the many efficient West disinfectants.

* Trade mark Reg. U. S. Pat. Off.

PROMOTING HEALTH IN INSTITUTIONS

WEST
A WEST GUARANTEED PRODUCT

● FREE copy of this illustrated booklet on request.

WEST DISINFECTING CO., *Dept. BU*, 42–16 West St., Long Island City, N. Y.

MIDLAND LABORATORIES

(Formerly Midland Chemical Laboratories, Inc.)

Dubuque, Iowa

MAN-POWER is at a premium. Many school custodial staffs have been drained by as much as 80 percent through the demands of our Armed Forces and Industries. The traffic that school buildings are now being forced to bear is much greater than that for which they were originally designed. This means that the forces of deterioration are increased many times that of normal times and therefore, the depreciation is also greater, not to mention the danger of epidemics present due to curtailed cleaning activities. Obviously, there is but one solution only—BETTER MAINTENANCE MATERIALS with their ability to accomplish more in less time to offset this man shortage.

Midland products will accomplish this for your school. Due to our large reserves, we are still in a position to offer only the highest quality in most products in our line and in the few cases of substitutions, only those which have passed the most rigorous tests are offered under the Midland symbol of Quality—your guarantee of satisfaction.

SOIL SOLV—All Purpose Cleaner

SOIL SOLV is a neutral cleanser composed of vegetable oils and synthetic wetting agents. These wetting agents enable it to remove imbedded dirt and grime with a minimum of effort, while the proper compounding of vegetable oils makes it completely safe to use on all types of floors, painted or varnished walls, and woodwork. Its easy-rinsing properties make for better cleaning with less effort.

MIDLAND PORCELAIN CLEANSER

So finely ground is the abrasive element in MIDLAND PORCELAIN CLEANSER that it is completely gritless. To this has been added a chemical emulsifier which loosens and lifts oil, grease, imbedded dirt and many of the stains to which porcelain is subject. One of the fastest acting cleansers of this type on the market, MIDLAND PORCELAIN CLEANSER may be used with complete safety on enamelware, earthenware, vitreous China and stainless steel.

LOHSEAL—Penetrating Floor Seal

LOHSEAL is primarily a wood seal, though it may be used advantageously on some other types of flooring. Made from phenolic resin, it is formulated not only to seal the pores of the wood against dampness and dirt, but to actually penetrate and reinforce the minute wood cells against the incessant pounding of traffic. This resiliency is not obtained through the use of spongy, semi-drying oils, but through the actual cellular reinforcement of penetrating elastic resins.

GYMLOH—Special Gymnasium Floor Finish

Midland was one of the first to note the advantages obtained through the use of phenolic resins in gymnasium floor finishes. Through the careful blending and cooking of these resins with essential oils, a long-wearing non-slippery floor finish of exceptional beauty and ease of maintenance is produced. A GYMLOH-finished floor is highly resistant to rubber burns, frictional heat, average stains, alcohol, body acids and alkalies.

NOTE:—LOHSEAL and GYMLOH were among the first seals and finishes to be approved by N.O.F.M.A. (National Oak Flooring Mfg. Assn.) and M.F.M.A. (Maple Flooring Mfg. Assn.).

EV-R-GLO—Self-Polishing Water-Resistant WAX

Without polishing or buffing, your floors can have a lacquer-like lustre not readily removed by either traffic or dampness. In fact, an EV-R-GLO-treated floor may be mopped again and again with cold water, before it becomes necessary to rewax. EV-R-GLO's wearing qualities are due to its Prime No. 1 Yellow Carnauba Wax content, the hardest natural wax known. Its emulsifier contains no paraffine, shellac, oil or petroleum derivatives injurious to wood, asphalt, rubber tile, terrazzo, marble, linoleum or composition surfaces. Extremely low in slip-hazard. Special felt applicator included with every purchase of EV-R-GLO.

MID CEDAR—Dry Mopping Preparation

Modern floors require modern methods of maintenance. To this end, MID CEDAR was developed. Cedar and other volatile oils were compounded to give a preparation which, when sprayed lightly on clean cotton-strand mops and dried, removes daily accumulations of dirt and soil without raising objectional dust or leaving a sticky film with which to attract more dirt. Regular use of MID CEDAR is an investment in economical maintenance. It actually cuts your scrub soap and labor costs by removing the necessity of frequent scrubbings.

A Complete Quality Line of

LIQUID HAND SOAPS—GERMICIDES AND DISINFECTANTS—INSECTICIDES—DETERGENTS
ELECTRIC FLOOR MAINTENANCE MACHINES—and GENERAL CLEANERS

SPECIAL GYMNASIUM FLOOR TREATMENTS AND MAINTENANCE

Special emphasis is now being placed on Physical Education. The training of Youth for their part in our War Effort begins in your gym. Rigorous Commando-Type training courses soon break down all but the hardest of gym floor finishes. It pays extra dividends, therefore, to have your floor finished with GYMLOH, Midland's special gymnasium floor treatment—a tough, elastic, non-slippery finish that has that extra measure of ''built-in'' wear. It is easily applied by means of a special lamb's wool applicator which is furnished free of charge with your order. Any one of your regular staff can achieve professional results, provided a few simple directions are followed.

The mortality of any gym floor depends largely upon keeping the surface free from sandy abrasive dirt. Rubber soled gym shoes have the unfortunate faculty of imbedding fine particles in their pores and acting in much the same manner as sandpaper. It is therefore important to the life of the floor that it be kept as free from such abrasives as possible. Perhaps the quickest, most effective way to do this is by means of dry mopping. To this end, Midland offers MID CEDAR, a dry mop preparation which, when sprayed upon cotton strand mops and allowed to stand 24 hours before use, acts as a dust absorber without leaving any trace of an oil residue upon the floor. And remember—one sweep of a MID CEDAR-treated mop accomplishes more than a half-dozen strokes of an untreated mop.

AIDS IN THE CLEANING AND STERILIZATION OF WASHROOMS

A clean, spotless washroom is its own recommendation of freedom from bacteria and odor. To achieve this in school lavatories requires daily attention and *cleaners made for that purpose.* Such a cleaner is MIDLAND PORCELAIN CLEANSER. Use it with safety on wash bowls, tile walls and bright-work. For the toilet bowls and urinals, use MIDLAND FLUSHOLEUM, to remove heavy scale, rust stains and discolorations with minimum unpleasantness and effort.

The cleaning of washroom floors is greatly expedited through the use of MIDLAND SOIL SOLV. Not only does SOIL SOLV remove surface dirt, but the imbedded grime as well. In the case of obstinate stains, we recommend the use of MIDLAND TILEOLEUM POWDER, a combined abrasive and bleach formulated to remove rust, paint, medicine, and certain other stains and spots from tile, marble and terrazzo without affecting their color.

For periodical disinfecting, a portion of MIDLAND NEO GERMOLYPTUS, hospital disinfectant and germicide, mixed with the scrub water gives complete germicidal protection. Frequent washings of toilet seats with NEO GERMOLYPTUS is also recommended as a necessary precaution.

Fill your soap dispensers with MIDLAND LIQUID HAND SOAP and note its economy and immediate acceptance by teachers and students alike.

THE DEVELOPMENT OF "CIVIC PRIDE" AMONG STUDENTS

The prankish disfiguration of school buildings and equipment has long been a source of trouble to school authorities. Some time ago, tests were conducted in a number of new school buildings in an effort to solve this problem. Briefly, these tests were as follows:

In one building certain desks were purposely marked in pencil and ink, then photographed. At the end of the semester, it was found that the marks on these desks had not only been multiplied but in many instances were carved into the wood. In another building, the desks received a treatment with MIDLAND LACQAIRLUSTR—a preserver and renewer of wood, chrome and leather. During the last period on every Friday, a pint can of LACQAIRLUSTR was furnished the first student in each row of desks, which in turn was passed to the next student in back, after application to the desk surface with a small piece of outing flannel. Thus was removed the week's accumulation of ink, pencil and perspiration marks and a protective finish applied.

As a result, a civic instinct was developed, a good habit was formed, and the desks immunized from abuse. It is peculiar to relate that in the school that formed the LACQAIRLUSTR Habit, walls and woodwork in washrooms also ceased to be a target for markings.

Perhaps a similar solution may be used advantageously in training your students to respect community property.

THE HILLYARD SALES COMPANY

BRANCHES IN PRINCIPAL CITIES | St. Joseph Missouri | DISTRIBUTORS FOR HILLYARD CHEMICAL CO.

A National Floor Treatment, Maintenance and Sanitation Organization . . .
Over Thirty-five Years Continuous Service

CLEANS SUPER PRESERVES
Shine-All
TRADE MARK
REG. U.S. PAT OFFICE POLISHES REG. U.S. PAT. OFFICE

SUPER SHINE-ALL. Not a soap, but a neutral liquid chemical cleaner for all types of floors, also painted and varnished surfaces. It possesses 100% active cleaning units. Super Shine-All cleans, polishes, and preserves in one operation, requiring no rinsing. Saves time and labor. Officially endorsed by leading floor manufacturers. The one cleaning material that is qualified for safe use on every description of floor or wall surface.

HIL-TONE. Hil-Tone removes rubber burns and other marks from wood floors. It not only removes the marks easily when properly used but also seals and protects the wood itself. The wood retains its light color and does not become oily or greasy as when ordinary dressings are used.

HIL-BRITE. A self-polishing water emulsion wax that dries bright without rubbing or polishing, with a hard traffic-resisting finish, yet has that soft lustrous glow of polished wax. It saves time and labor; cuts your waxing and cleaning costs in half. Endorsed by national floor manufacturers.

ONEX-SEAL. Gives positive protection and restores the original attractive finish to terrazzo, tile and cement. Tests proved Onex-Seal capable of withstanding the most severe weather and traffic conditions. Onex-Seal produces a waterproof, weatherproof, dust-resistant, sealed polished surface. Nationally recommended by flooring contractors and manufacturers.

TERRAZZINE. Excels for thorough curing and sealing of new terrazzo and cement. Used and endorsed by leading terrazzo contractors and has a nation-wide performance reputation. Economical and simple to apply.

HIL-FINISH. Especially designed to serve on classroom and gymnasium floors. Universally used for the reclamation and preservation of wood floors in all types of buildings. Hil-Finish is supreme for wearing quality, is non-skid, and does not easily rubber-burn. Approved by Flooring Manufacturers.

To protect our customers against imitations all Hillyard products are registered and trademarked and shipped in sealed, checker board designed containers

SUPER GYM FINISH. Produces a non-slippery, durable and sanitary floor, easy to maintain. Withstands hard and constant wear; gives proper reflection of light, eliminating eye strain; insures a perfect non-slippery surface which will not rubber-burn. Nationally used by leading schools, universities and athletic clubs, private and public institutions.

DIAMOND FINISH. Produces a brilliant, long-wearing surface, easy to apply with brush or mop. Quick-drying and especially adapted for wood floors.

PENETRATING SEAL NO. 21. The purpose of Penetrating Seal is to seal the fibre against penetration of dirt, ink stains and moisture, to preserve the natural color of the floor and provide a more permanent finish that is both beautiful and economical, and to reduce maintenance costs. Penetrating Seal No. 21 and Bil-rite Self Polishing Wax is the ideal treatment for floors of classrooms, corridors, assembly halls, etc. This treatment preserves the natural color of the wood, is easily and economically maintained, and produces a durable and attractive finish.

HIL-SEAL. A tested and approved (by Maple Flooring Mfg. Assn., Oak Flooring Mfg. Assn. and others) seal for wood floors. Penetrates into floor making it traffic resistant, easy to clean and more attractive in appearance.

HILLYARD'S WOOD PRIMER. Definitely seals and preserves; insures an ideal surface for the application of any desired finish or treatment. Universally used for the reclamation and preservation of wood floors in all types of buildings.

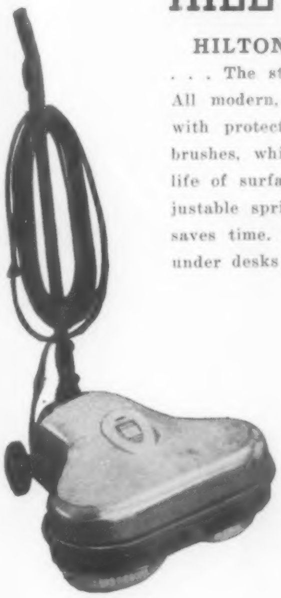
NEUTONE. A wood floor dressing and treatment, that leaves a hard, transparent, wax-like surface on wood floors without destroying the original color and beauty of the floor. Recommended for floors containing movable desks and furniture. Neutone is a special blend of hard waxes and penetrating floor dressings, that is especially adapted for maintenance of sealed floors with the Steeltonian Buffing and Floor Treating Conditioning Machine.

HIL-KOTE is a liquid treatment for wood, cork, linoleum, porous tiles in public and private institutions. Composed of fossil gums and tough raw waxes blended with materials and solvents, it produces a hard lasting finish coat with a soft, attractive sheen that eliminates the necessity of frequent re-treating. Produces a non-slip surface.

"FROM COAST TO COAST"

Madison Square Garden, New York, N. Y.   **Stanford University Basketball Pavilion, Palo Alto, Calif.**

HILLYARD'S MODERN FLOOR MACHINES



HILTONIANS. The Hiltonian line . . . Combination Scrubbing, Polishing and Waxing Machines . . . Three models . . . The sturdy 22-inch Master Lowboy . . . The 19-inch all purpose Lowboy . . . The 16-inch handy Lowboy . . . All modern, sturdy . . . Co-ordinating speed, power and weight . . . Latest type General Electric Capacitor Motor with protective General Electric Thermotector, not found on most machines . . . Twin interlocking, interchangeable brushes, which eliminates streaking . . . Cuts time and labor in scrubbing, polishing and buffing. . . . Adds years to life of surfaces maintained . . . Adjustable wheels cut down power consumption and quickens cleaning action . . . Adjustable spring handle protects furniture and helps machine operator . . . Snap-action mechanism for changing brushes saves time. . . . Timken bearings . . . Durable non-corrosive alloy construction . . . Underslung lines permits passing under desks . . . A model for every type institution—a size for every pocketbook.

STEELTONIANS. The Steeltonian with many Hillyard exclusive patents was developed after years of research, testing and designing to do one job and do it the most economically. It not only dry-cleans a wood floor, but it drives Hillyard seals more deeply into the wood fibres and finally does an excellent job of polishing, leaving a smooth, non-porous, non-slippery floor that is easy to maintain, impervious to dirt, stains and moisture. Features all Steel Construction—Unbreakable. Drum rigidly supported at Both Ends. Completely Guarded. Dustless. Works with the grain. Correct Speed and Balance. Goes Right Up to Quarter Round. Portable. Economical—"Roll Your Own Steel Wool." Easy to Operate. General Electric Motor.

RENOVATOR. Hopelessly black and gummy floors can be brought out to look like new with Hillyard's Renovator. Oil-soaked wood floors can be scrubbed and bleached to a light color. The extra power in Renovator makes the toughest job easy.

VICTOR SOAP DISPENSER. Built substantially in modernistic design with frame of brass, chromium plated. The bowl of opalescent glass, hung in the frame on an eccentric balance, automatically rights itself, preventing loss of soap by drippage. No springs to get out of order. A ball-bearing valve releases small amounts of soap. **Adapted to two positions, either upright or mounted on wall.**

HAN-SAN HAND SOAP. Shipped in concentrated form, insuring the customer of 100% value in every gallon. Although usually shipped and prepared in its natural state, Han-San may be had in various colors and perfumes. Han-San provides individual hygiene when used in our dispensers. It is a forward step toward eliminating sickness and disease spread by unsanitary bar soap.

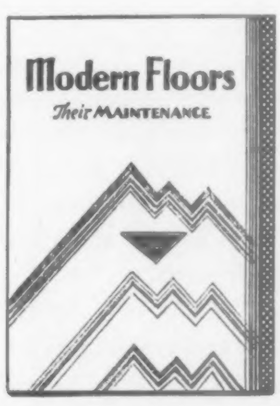
WINDO-CLEAN. This lightning cleaner dissolves grime and removes dirt. No effort. No mess. No hard work. Eliminates buckets, sponges, water, squeegees and chamois, and makes glass sparkle.

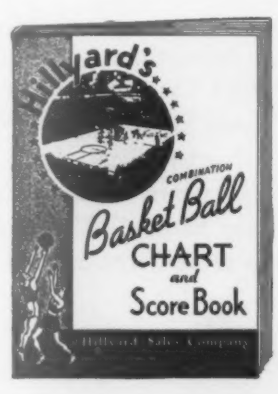
HI-KO DISINFECTANT. A concentrated stabilized sodium hypochlorite solution. When diluted with water in proper proportions, it is effective as a sterilizer, antiseptic, germicide and deodorant. Used in correct solution in a rubber foot bath tray it helps to rid showers and locker rooms of the trouble-some germ which causes "Athlete's Foot."

Rubber Foot Bath Tray

PINE-O-CIDE, ANOTHER EFFICIENT DISINFECTANT. An efficient liquid, amber-colored, both antiseptic and disinfecting. Compounded from steam double distilled Pine Oil, it possesses a pleasant pine odor which is soothing to the membranes of the nose and throat. Pine-O-Cide is soluble in water, forming a beautiful milk white emulsion, possessing a typhoid phenol co-efficient of five, "F.D.A." Method (report of testing laboratory furnished on request). The use of Pine-O-Cide promotes sanitation in schools and public buildings.

FREE ON REQUEST . . . FOUR VALUABLE HELPS





Below: Gymnasium, Lee Edwards School, Asheville, N. C.

Finished with Selig's JIM KOTE

JIM KOTE

A mighty fine, chemically balanced bakelite and tung oil gymnasium finish. Does not rubber burn, impervious to alkali, salt water, alcohol and common acids. Easily maintained. Plenty of traction. An ideal finish. Our numerous satisfied customers are, we believe, the best judges. Their complete satisfaction makes us believe you also will be pleased. Jim Kote is easily applied by the mopping method.

FLOR-O-SEAL

Especially developed for classroom use. This penetrating seal, when properly applied, does not leave a surface film. Thus, Flor-O-Seal does not show unsightly traffic lanes. It wears well, is easily maintained and is economical. The application is very easy and simple.

FLOOR MAINTENANCE SERVICE

The SELIG trained and experienced floor maintenance engineers are qualified to assist you in any problem of scientific floor finishing and maintenance. They will gladly assist you in setting up the proper and most economical schedule of maintenance. Please discuss your problems with us freely.

We manufacture a complete line of floor maintenance materials and equipment. Our various materials have been approved by the leading makers of flooring materials such as Wood, Linoleum, Cork, Rubber and Asphalt Tile, Marble, Terrazzo, Magnesite, Masonite, etc.

DISINFECTANTS — INSECTICIDES — LIQUID TOILET SOAPS

In addition to the famous line of floor materials, the name SELIG has been synonymous with the highest standards of Disinfectants, Insecticides, Liquid Toilet Soaps and Sanitary Supplies for over forty years.

Put your problems up to us and permit us to offer suggestions and advice. There's no obligation involved and it may be of mutual benefit. Write for our big free complete catalogue.

THE SELIG COMPANY, INC.

DALLAS ATLANTA NEW ORLEANS

Manufacturers of

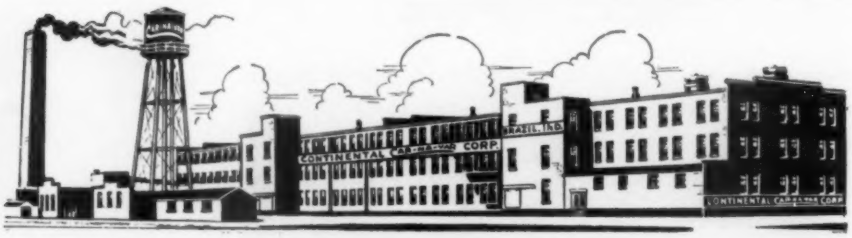
Floor Finishes — Waxes — Cleansers — Polishes

ESTABLISHED 1896

CONTINENTAL CAR-NA-VAR CORPORATION

1527–29 E. National Ave., Brazil, Indiana

WAREHOUSES AND EXPERIENCED FLOOR MAINTENANCE ENGINEERS IN PRINCIPAL CITIES OF THE U. S. A.



World's Largest Manufacturers Specializing in FLOOR TREATMENTS FOR LARGE FLOOR AREAS IN SCHOOLS AND UNIVERSITIES

● RELIABILITY

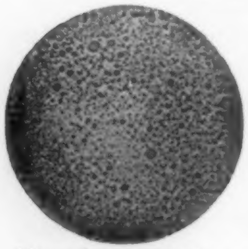
For many years we have specialized in the manufacture of floor treatments for large floor areas and are today the largest manufacturer in the world devoted to this field. For that reason we have the experience and facilities for producing the most efficient products. Balance these points against the following three classes of competitive materials . . . those primarily designed for the less severe strain of the dwelling . . . those finishes offered as mere side-lines by general manufacturers . . . and those materials made by small, inexperienced concerns with little or no responsibility.

We have many trained floor engineers in the field who service our products to see that the customer obtains maximum efficiency. Dun & Bradstreet gives us high first class rating. We are incorporated for $1,000,000. Our products are in use in all parts of the world, including the Army and Navy. They are approved by the leading manufacturers of floors and endorsed by thousands of users.

● SERVICE OFFICES

Service offices and warehouses in principal cities of the United States with an experienced floor maintenance engineer in charge of each.

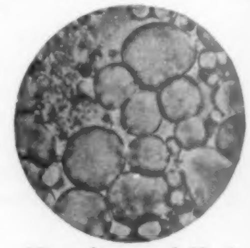
CAR-NA-VAR FLOOR TREATMENTS ARE SCIENTIFICALLY MADE



Microphotograph No. 1

Car-Na-Var Floor Treatment compounds are made of the best materials available. In our modern factory these raw materials are tested for uniformity, blended by expert chemists, processed by special processing equipment and finally tested for uniformity of the finished product.

The special processing breaks the globules of varnish gums and waxes into minute particles as shown in Microphotograph No. 1 above. This processing insures greater covering capacity, greater penetration, greater wearing qualities, and because of perfect distribution, freedom from slipperiness. Microphotograph No. 1 shows what Car-Na-Var products look like when magnified two thousand times. Compare this with the coarse globules of wax and gums in ordinary floor treatments as shown in Microphotograph No. 2, also magnified two thousand times.



Microphotograph No. 2

Car-Na-Var products are better products because they are scientifically and accurately made.

CAR-NA-VAR TRADE MARK REG. U.S. PAT. OFF. THE PERFECT FLOOR TREATMENT

MOST DURABLE FLOOR TREATMENT EVER MADE

Car-Na-Var is the original varnish-gum and wax floor treatment that combines the durability of varnish with the scratch-resisting qualities of wax. Gives a beautiful, lustrous WATERPROOF finish to all types of floors except rubber and asphalt . . . is non-slippery. Car-Na-Var requires no undercoat of sealer . . . although it is readily applied over any seal. Use Car-Na-Var if you have an electric floor machine for buffing . . . it requires more initial labor than a self-polishing wax but is much longer lasting. Applied with a mop; ready for use in an hour. Supplied in "natural" (stainless), Dark Oak, Light Oak, Walnut, Cherry, Mahogany, Maroon, Olive Green and Mission. Meets U. S. Treasury specification for "Undercoater A."

CAR-NA-LAC TRADE MARK REG. U.S. PAT. OFF. LACQUER-LIKE FLOOR FINISH

If you do not have a floor machine or buffer, or object to polishing, use Car-Na-Lac . . . it is "self-polishing." Radically different from all other self-polishing floor treatments! Easily applied with mop or cloth, it goes on like lacquer . . . leveling itself out to a brilliant streakless luster . . . dries like wax in less than 30 minutes. Can be used on all types of smooth, sealed or fairly non-porous floors including rubber and asphalt. Waterproof . . . non-slippery. Meets U. S. Treasury specifications for "Finish Material" (except for percentage of solids).

CONTINENTAL "18" TRADE MARK REG. U.S. PAT. OFF. THE SUPER FLOOR FINISH

A super-finish for floors; made and applied in exactly the same way as Car-Na-Lac but contains about 38% more solid content. Designed for extra heavy duty. Recommended by a large Casualty insurance company for safety. Meets U. S. Treasury Department specifications for "Finish Material."

CAR-NA-SEAL
WEARS LIKE LEATHER

SPECIALLY DEVELOPED FOR GYMNASIUM FLOORS

Two coats of Car-Na-Seal, applied once each year, keeps the 6000 sq. ft. gymnasium floor of the Highland Public School, Highland, Illinois, in tip top shape

A deep-penetrating seal for all wood floors—tough as leather and thoroughly pliable—that gives a smooth satin-like luster, free from streaks and scratches. Car-Na-Seal requires no buffing. Marks left by rubber soles (rubber burns) are easily removed. Made from Bakelite and other phenolic resins, specially processed for longer wear. Although used frequently as an undercoater for Car-Na-Lac, Continental "18" and Car-Na-Var, Car-Na-Seal is an ideal top dressing for gymnasium floors. Provides a firm, safe footing. Preserves the floor by excluding moisture and dirt from the pores . . . protects markings of basketball court, etc. Car-Na-Seal also provides an excellent finish for school desks. Meets U. S. Treasury specifications for "Sealer C." Average coverage 500 sq. ft. per gallon.

RUBBER-VAR
FOR TREATING RUBBER FLOORS

The thinners used in floor waxes and other treatments, while harmless to most floorings, are usually highly injurious to rubber and in the case of certain soft composition floors cause the colors to run. In view of this, we have taken the solid content of Car-Na-Var (which combines varnish gums and hard waxes) and emulsified it to use on rubber and composition floors. The result is "Rubber-Var."

Rubber-Var is waterproof and is applied with a mop, drying almost as fast as it is applied. It is then polished by buffing, responding to a very high polish. Rubber-Var forms a protective coating for rubber or soft composition floors, preserving them from their natural enemies—oils, air and the friction of traffic; also making the rubber or soft composition floor much easier to clean and keep clean, eliminating the need of frequent scrubbing. It also prevents colors from "running." Longer lasting than self-polishing waxes. Waterproof.

SILENT CHIEF ELECTRIC FLOOR MACHINE

Like driving a high-powered automobile, the "Silent Chief" actually runs itself . . . you merely hold lightly onto the handle to steer. Special geared-head motor gives maximum efficiency . . . yet hours of polishing, scrubbing, steel wooling, sanding or grinding will not tire the operator because its perfect balance calls for no physical effort. Can be easily converted into a rug-scrubbing machine. Available in 5 sizes.

CAR-NA-PAINT

Car-Na-Paint for floors is made by grinding color pigment into Car-Na-Seal, giving the same very durable, flexible finish as Car-Na-Seal. Because it is highly alkali and acid resisting Car-Na-Paint is especially adapted for concrete floors. Applied with paint brush. Coverage same as Car-Na-Seal. Supplied in following colors: Light Gray, Dark Battleship Gray, Maroon, Dark Brown, Battleship Brown, Tile Red and Green.

DE-TER-GO

De-Ter-Go is a white powder, manufactured by a special process resulting in a cleaning agent of most remarkable qualities; a cleaner so mild that it may be handled freely, may be used in the bath, and yet so powerful, when properly used, that it will remove paint and varnish. For cleaning oil-soaked floors it has no equal, removing the surface oil and restoring the former color of the floor without harming the floor. De-Ter-Go is also especially adapted for cleaning rubber floors. Meets U. S. Treasury specifications for "Cleaner B."

CLEAN-O-SHINE

Clean-O-Shine is a cleaner of a creamy consistency and is free from alkali, acids or abrasives and therefore harmless to the finest finish; at the same time, it is a highly efficient cleaner. Being made of a high grade vegetable oil, it is, in fact, a "floor food" and if not rinsed after scrubbing, acts as a filler on porous surfaces, while on varnished or painted surfaces it renews the luster and forms a protective coating. It possesses a very pleasant, sanitary fragrance which has a decided deodorizing effect, eliminates the smell of wet wood, soapsuds, etc., as well as other disagreeable odors. If to be followed with Car-Na-Var, Car-Na-Lac, etc., floor should be rinsed free of Clean-O-Shine. Meets U. S. Treasury Department specifications for "Cleaner A."

CAR-NA-VAR PORTABLE VACUUM

For Wet and Dry Pick-up

Picks up 6 ft. "2 x 4"

Never before has a portable heavy duty vacuum machine offered such powerful cleaning action plus such quiet operation . . . quieter even than a small household machine. Designed for both "wet" and dry pick-up, the new silent Car-Na-Var is an ideal machine for the school, where quiet and cleanliness are of equal importance in the daily routine. The new compact design makes the Car-Na-Var easier to use, easier to keep clean. New sturdy construction means trouble-free operation . . . longer life.

FREE BOOK!

Tells how 18 superintendents and building managers of important schools, hospitals, office buildings and other public institutions cut floor maintenance costs. Gives actual figures and specific details. Sent FREE to maintenance executives. Write for your copy today . . . on your business stationery, please. There's no obligation attached.

THE FULLER BRUSH COMPANY

INDUSTRIAL DIVISION

3593A Main Street — Hartford, Conn.

World's Largest Manufacturers of School Cleaning Equipment

Library, Burns School, Hartford, Conn.

YEARS of experience have taught School Superintendents, Purchasing Agents and Janitors that there's nothing equal to Fuller Brushes and Cleaning Equipment for quality and long service.

The maintenance of high standards of cleanliness in schools and similar institutions is of vital importance.

You can profit from this experience by adopting these tried and proven Cleaning Tools. They represent real value for your brush dollar. Send for our complete Catalog.

There's a Fuller Tool for Every School Cleaning Need

THE KENT COMPANY, INC.

174 Canal Street, Rome, N. Y.

BRANCH OFFICES

New York — Philadelphia — Washington, D. C. — Hartford, Conn. — Los Angeles, Calif.

KENT

FLOOR MAINTENANCE

SCRUB *and* MOP

Electrically
with
Kent Equipment

Well scrubbed quickly
dried floors last longer.

Kent Floor Machine

Kent Electric Mopper

MODERN

CONVENIENT

DEPENDABLE

GEERPRES WRINGER, INC.

Muskegon, Michigan

GEERPRES

MOP WRINGERS & TANKS

A GEERPRES
Floor Cleaning Unit

certainly does take the mess out of mopping! A single downward stroke of the lever, and the mop is wrung out and ready for use on the floor, enabling the school janitor to wash and rinse floors quickly and thoroughly.

The Floor Cleaning Unit consists of a long-lived GEERPRES Wringer, of the famous downward pressure type, making it splashless and safe. The Tank on its Chassis has ball bearing casters, with soft rubber wheels. This eliminates injury to your floor, with less noise in operation. This Unit is available in two sizes, with single or twin tank models.

Double, Staggered Gears Cannot Possibly Side Slip

Patented

Gear Shaft Size Increased

Will Not Warp Under Excessive Strains

Fig. 3-a

Advantages

Long time service—no parts to crack or warp — no splash — no rust.

Will not mar or scratch floors.

Preserves mops in the best condition for rapid mopping.

Wrings quickly and uniformly, with no loose mop strings to catch around legs of chairs and tables. Force is exerted downward upon the mop, the natural way for the water to flow.

Simple in operation — a downward stroke of the lever extracts the water.

Fully guaranteed.

Pictured below—

TWIN TANK UNIT No. 1624T

Consists of one wringer, two 32-quart removable galvanized tanks, one two-compartment chassis with 24" x 1" rubber bumper on each end. Length 31". Width 17". Approximate weight 47 pounds. Wringer and chassis, cadmium plate and durable baked finish. A similar unit — No. 2436T — is made with larger tanks (44-quart), length 33", width 18", approximate weight 60 pounds. Wringers in all models have double-staggered gears which cannot possibly side-slip. All models have double ball-bearing casters and soft rubber wheels.

Below (center)

GEERPRES UNIT No. 2436

Consists of wringer for all sizes of mops from 20-ounce to 36-ounce, single tank and chassis. The Wringer has double-staggered, non-slipping gears; extra long handle with large rubber grips; cadmium plate and durable baked finish; electric arc welded construction. The wringer fits round or square containers. Weight 17 pounds. Width of wringer inside mop compartment, 7¼"; length inside, 9¼"; depth when open, 7¾". Height of complete unit to top of handle extended, 39".

Below (right)

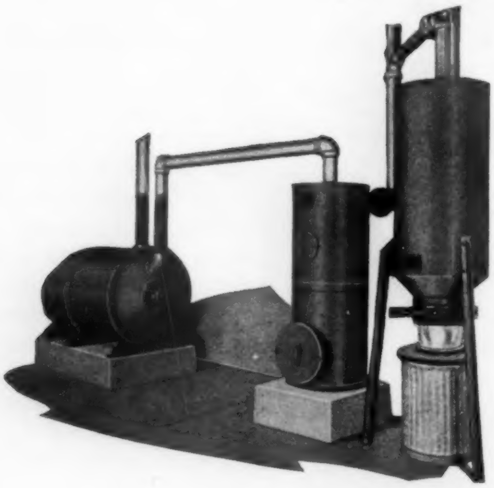
GEERPRES UNIT No. 1624

Consists of wringer for mops from 14-ounce to 24-ounce. Fits round or square container. Has double-staggered, non-slip gears. Made of steel, fully guaranteed. Cadmium plate and durable baked finish. Width of wringer inside mop compartment 6"; length inside 8¼"; depth, open, 7½". Height of unit including wringer handle, 31". Tank capacity 32 quarts. Weight of complete outfit—wringer, tank and chassis—25 pounds.

NOTE: Gears are enclosed.

THE SPENCER TURBINE COMPANY

Hartford, Connecticut



THE SPENCER CENTRAL VACUUM CLEANING SYSTEM

The Spencer Central Vacuum Cleaning System has met with the approval of architects and engineers everywhere, and has been installed in more than 10,000 buildings, including more than 1500 school buildings.

Spencer Central Vacuum Cleaning is a permanently installed system for the speedy and complete removal of dirt and dust from all kinds of floors, walls, ceilings, furniture and other building equipment. It consists of five essential parts, each carefully selected to meet the special requirements for each individual building:

1. A vacuum producer, located in the basement. 2. Inlet valves, conveniently located on all floors and piped to vacuum producer. 3. Specially designed, entirely enclosed, and easily cleaned separator. 4. Light weight, flexible hose. 5. Special vacuum tools for each operation.

Advantages—In exhaustive tests in leading schools, the powerful vacuum, scientifically applied with correct tools, has demonstrated its ability to remove more of the dirt in less time than other methods.

Because the equipment is simple in design, requiring little attention and because these systems are built to provide satisfactory service over long terms of years, both the operating and amortization costs are extremely low.

One janitor can clean twelve average sized class rooms in two hours with a 3 HP Spencer System. The Spencer elbow joint makes cleaning around furniture easy.

For Cleaning Erasers and Chalk Trays—Spencer Vacuum Cleaning, instead of scattering the great bulk of the chalk dust on the floor, provides a method of cleaning erasers and chalk trays that is rapid, sanitary, easy and thorough. The janitor has only to attach a special tool and move it across the surface of eraser or chalk tray.

Cleans the Boiler Room—Spencer Vacuum cleans boiler room floors—removes dust and soot from pipes and draws soot out of the boiler tubes, often saving the whole cost of operation in this one item alone.

Swimming Pool Cleaning Equipment—By means of special cleaning tools usually employed in connection with the pump on the filtering system, it is possible to remove accumulated sediment from swimming pools without the waste of water involved in draining the pool. Bulletin on request.

SPENCER PORTABLE VACUUM CLEANERS

The Spencer 1/3 HP Portable Vacuum Cleaner shown above weighs only 34 pounds. The 3/4 HP unit shown below weighs 150 pounds. Both are built on the same principles of design as the larger Spencer units, and use the same vacuum tools. Easy to clean, easy to use, and built for long life service.

SECTION III
ARCHITECTS FOR EDUCATIONAL BUILDINGS

All the architects listed in this Directory are now at work on educational buildings or have designed a number of school and college buildings in recent years.

No attempt has been made to evaluate the skill or professional standing of the architects listed. Boards of Education and persons interested in the construction of new buildings can obtain valuable advice in this matter from the presidents of the local chapters of the American Institute of Architects, or from the national headquarters of that organization, The Octagon, Washington, D. C., and from such sources as the National Advisory Council on School Buildings, the United States Office of Education, the respective state departments of education, the Department of Education of the National Catholic Welfare Conference, and the Department of Educational Administration of Teachers College, Columbia University, New York.

Alabama

Birmingham

Charles H. McCauley, Jackson Bldg.
Miller, Martin & Lewis, Title Guarantee Bldg.
Jack B. Smith, Martin Bldg.
E. B. Van Keuren, 221 Martin Bldg.
Warren, Knight & Davis, Protective Life Bldg.

Gadsden

Paul W. Hofferbert, 220 S. 8th St.
*Matthews H. Tardy, 200 S. 8th St.

Mobile

Fred W. Clarke, 1900 Merchants Nat'l Bank Bldg (Box 301)
Wm. H. March, Box 813
Roberts & Long, Annex First National Bank Bldg.

Montgomery

Carl B. Cooper, 10 Walnut St.
R. L. Kenan & Associates, Bell Bldg.

Ozark

H. L. Holman, Jr., Holman Bldg., Court Square

Sheffield

Howard A. Griffith, Jr., Nashville Ave.

Tuscaloosa

Don Buel Schuyler, 910 First Nat'l Bank Bldg.

Arizona

Luke Field

Donald McCormick, Box 40

Phoenix

Lescher & Mahoney, 1100 Title & Trust Bldg.

Tucson

Arthur T. Brown, 740 N. Country Club Rd.
Henry O. Jaastad, 103 Miltonberg St.
J. T. Joesler, Box 1709
James Macmillan, 537 E. 3rd St.
Roy W. Place & Lew Place, 20 E. Pennington St.

Arkansas

Fayetteville

Paul Young, Jr., McIlroy Bank Bldg.

Fort Smith

Haralson & Mott, 229 Merchants Bank Bldg.
E. Chester Nelson, 427 Merchants National Bank Bldg.

Jonesboro

W. R. Curzon

Little Rock

Brueggeman, Swaim & Allen, 331 Gazette Bldg.
Ginocchio & Cromwell, 219 Hall Bldg.

Pine Bluff

Mitchell Selligman, 202-203 Nat'l Investment Bldg.

Texarkana

Horace H. Harner, 2320 Locust St.

California

Alhambra

*Richard C. Farrell, 731 N. Marguerita Ave.
Quintin & Westberg, 308 S. Garfield Ave.

Bakersfield

Charles H. Biggar, 267-268 Haberfelde Bldg.

Berkeley

John J. Donovan, 950 Parker St.
Dragon & Schmidts, 2068 Allston Way
Wm. C. Hays, 2924 Derby St.
W. H. Ratcliff, 2323 Shattuck Ave.

Burlingame

*E. L. Norberg, 407 Occidental Ave.

Culver City

C. Dakin, 10823 Braddock Drive

Fresno

Fred L. Swartz, 1022 Cambridge

Glendale

Postle & Postle, 1900 Melwood Drive

Hillsborough

William H. Rowe, 1035 Lancaster Rd. (San Mateo P. O.)

Hollywood

H. L. Gogerty, 1717 N. Vine St.

La Crescenta

Wm. Mellema, 3027 Henrietta Ave.

Lemon Grove

A. O. Tregonza, Box 97

Long Beach

Warren Dedrick, 815 Heartwell Bldg.
D. Easton Herrald, 435 First Nat'l Bank Bldg.
Jess J. Jones, 303 F. & M. Bank Bldg.
Victor E. Siebert, 32 Ximeno
Kenneth S. Wing, 4320 Olive St.

Los Angeles

Wm. Allen & W. G. Lutzi, 5655 Wilshire Blvd.
John C. Austin, 608 Chamber of Commerce Bldg.
C. A. Balch, 6307 Wilshire Blvd.
M. L. Barker & G. Lawrence Ott, 624 S. LaBrea Ave.
Paul O. Davis, 417 S. Hill St.
Ralph C. Flewelling, 816 W. 5th St.
Wm. H. Harrison, 816 W. 5th St.
L. H. Hibbard, 816 W. 5th St.
C. Raimond Johnson, University of Southern Cal., 3551 University Ave.
Kistner, Curtis & Wright, 715 Architects Bldg.
Kauzor Bros., 4954 Cromwell Ave.
Samuel E. Lunden, 4585 Spring St.
Marsh, Smith & Powell, 816 W. 5th St.
Albert C. Martin, 108 W. 2d St.
A. S. Nibecker, Jr., Bd. of Education, 1425 San Pedro St.
Raphael A. Nicholais, 5670 Wilshire Blvd.
Elwin P. Norberg, Bd. of Education, 1445 S. San Pedro St.
Harry L. Pierce, 1443 Mt. Pleasant St.
Thos. Franklin Power, 6834 Odin St.
U. F. Rible, 1689 Comstock St.
Lester T. Squiers, Union League Bldg.
Edward Cray Taylor and Ellis Wing Taylor, 803 W. 3rd St.

Montebello

O. J. Bruer, 817 Washington Ave.

Monterey

C. J. Ryland, 136 Bonifacio Pl.

Oakland

Will G. Corlett & Arthur W. Anderson, 1801 Bank of America Bldg.

Palm Springs

J. P. Clark, Box 142

Palo Alto

Birge M. Clark & David B. Clark, 310 University Ave.

Pasadena

Walter C. Folland, 224 S. Oak Knoll Ave.
Frederick Kennedy, Jr., 1041 E. Green St.

Pebble Beach

Robert Stanton

Riverside

G. Stanley Wilson, 3681 Sixth St.

Sacramento

Chas. F. Dean, 1407 California State Life Bldg.
Harry J. Devine, Cronan Bldg.
H. Goodpastor, Mitau Bldg.
Geo. C. Sellon, 1313 California State Life Bldg.
Leonard F. Starks, 310 Bank of America Bldg.

Salinas

Chas. E. Butner, 7 Winham St.

San Diego

E. L. Freeland, 601 Spreckles Bldg.
C. H. Holmstrom, 3316 Gregory St.
Frank L. Hope, Jr., 1008 San Diego Trust & Savings Bldg.
Sam W. Hamill, 1123 Bank of America Bldg.
Clyde Hufbauer, 2101 Commercial St.
Wm. Templeton Johnson, 1400 San Diego Trust & Savings Bldg.
Kistner, Curtis and Wright, 665 Spreckels Theatre Bldg.
Wm. P. Lodge, 509 Fifth Ave. Bldg.
John S. Siebert, 311 Granger Bldg.
Harry K. Vaughn, 2172 Front St.

San Francisco

Blanchard & Maher, 369 Pine St.
Arthur Brown, Jr., 251 Kearny St.
Norman R. Coulter, 244 Kearny St.
R. G. De Lappe, 564 Market St.
Edwards & Schary, 704 Market St.
Walter C. Falch, 1202 Hearst Bldg.
John J. Foley, 770 Fifth Ave.
David H. Horn, 564 Market St.
Kent & Hass, 525 Market St.
Ernest J. Kump Co., 251 Kearny St.
Masten and Hurd, 369 Pine St.
Maybeck & White, Russ Bldg., 235 Montgomery St.
J. R. Miller and T. L. Pflueger, 580 Market St.
Wm. Mooser, 244 Kearny St.
Keith O. Narbett, 564 Market St.
Wm. & Harold H. Weeks, 593 Market St.

San Jose

Binder & Curtis, 35 W. San Carlos St.

San Luis Obispo

H. B. Douglas, 75 Benton Way

San Rafael

Carl F. Gromme, 1010 B St.

Santa Barbara

E. Keith Lockard, 1746 Prospect St.

Santa Paula

Roy C. Wilson, Box 951

Santa Rosa

C. A. Caulkins, Jr., Rosenberg Bldg.

Stockton

Elmore G. Ernst, 561 E. Harding Way
Frank V. Mayo, 3119 North American St.
Jos. Losekann, 311 E. Market St.
A. N. Story, 120 E. Magnolia

Van Nuys

Lester G. Scherer, 4632 Atolliave

Colorado

Colorado Springs

Edw. L. Bunts, 348 First Nat'l Bank Bldg.
Earle A. Deits, Mining Exchange Bldg.

Denver

Wm. N. Bowman, 614 Insurance Bldg.
T. H. Buell & Co., 730 14th St.
H. W. J. Edbrooke, 512 Tabor Bldg.
Huntington, Jones & Hunter, Box 2323
Jamieson & Stiffler, 818 12th St.
Roland L. Linder, Insurance Bldg.
John K. Monroe, 22nd St. & Broadway
Earl C. Morris, 1015 Midland Savings Building
G. Meredith Musick, 1000 Paterson Bldg.
Richard O. Parry, 3855 Harlan St.
C. Francis Pillsbury, Midland Savings Bldg.
Dudley T. Smith, Boston Bldg.
Gordon D. White, 615 Columbine St.

Pueblo

Walter DeMordaunt, 738 Thatcher Bldg.

Connecticut

Bridgeport

Leonard Asheim, 211 State St.
Frederick H. Beckwith, 115 Wall St.
David N. Plumb, 1988 Huntington Tpke., Mihals

Danbury

Philip Nichols Sunderland, Inc., 81 West St.

Fairfield

O. C. S. Ziroli, 1330 Post Road

Groton

G. L. Bilderbeck, 76 Starr Hill Road

Hartford

Golden, Storrs & Co., 343 Fairfield Ave.
Carl J. Malmfeldt & Associates, 36 Pearl St.
John J. McMahon, 187 Barker St.
Frank W. Whiton, 550 Main St.

Litchfield

Ernest Sibley

Meriden

Lorenzo Hamilton, 77 N. 4th St.

Middletown

Wm. T. Towner, 164 Court St.

New Haven

Brown & Von Beren, Inc., 295 Sherman Ave.
R. W. Foote, 157 Church St.

New London

Payne & Keefe, 231 State St.
Scholfield & Lindsay, 309 State St.

North Haven

R. H. Booth, Old Orchard Rd.

Norwich

Chandler & Palmer, Thayer Bldg.

Stamford

Provoost & Everett, 421 Main St.

West Hartford

Russell F. Barker, 17 Staples Place
Wm. T. Marchant, 28 Walbridge Road

Delaware

Wilmington

Walter Carlson, P. O. Box 1372
G. Morris Whiteside, 2nd, 2162 DuPont Bldg.

District of Columbia

Washington

Walter Boschen, 100 Irvington, S. W., Apt. 10
Rhees E. Burket, 1223 Connecticut Ave. (Also Silver Springs, Md.)
Albert I. Cassell, 1903 14th St., N. W.
Faulkner & Kingsbury, 917 15th St.
George Howe, Room 5314 Natl. Interior Bldg.
Maurice S. May, 1223 Connecticut Ave., N. W.
H. R. Robinson, 1927 11th St., N. W.
Upman & Adams, 808 17th St., N. W.
A. Hamilton Wilson, 1022 20th St., N. W.
Nathan C. Wyeth, Municipal Architect, District Bldg.

Florida

Daytona Beach

Harry M. Griffin, 309 N. Grandview Ave.

Fort Lauderdale

Courtney Stewart, 311 S. E. 7th St.

Fort Myers

N. G. Walker, 2216 Broadway

Gainesville

*Sanford W. Goin, 230 E. Main St.

Jacksonville

Mellen C. Greeley, 218 W. Church St.
Max L. Worthley, 605 Ocean St.

Lakeland

W. B. & Thomas V. Talley, P. O. Box 1104

Lake Worth

*Edgar S. Wortman, 1428 North Lakeside Drive

Miami

Kiehnel & Elliott, 422 Seybold Bldg.

Miami Beach

August Geiger, 1665 Meridian Ave.
Robert M. Little, 4830 Cherokee St.

Pensacola

S. J. Welch, 1306 E. Jackson St.
Younge & Hart, 28½ South Palafox St.

St. Petersburg

Archie G. Parish, 213-215 Hall Bldg.

Tallahassee

T. Angus MacEwen, 108 Briarcliffe Drive
Herbert D. Mendenhall, 814 N. Jefferson St.
Jas. A. Stripling, State Dept. of Education

Georgia

Atlanta

Burge and Stevens, Palmer Bldg.
Wm. J. J. Chase, 140 Peachtree St. (also in Albany, Ga.)
David S. Cuttino, Jr., 1250 University Drive, N. E.
Hentz, Adler & Shutze, 1330 Candler Bldg.
Ivey & Crook, Candler Bldg.
Henry H. Jordon, 214 Healey Bldg.
Odis Clay Poundstone, 216 Palmer Bldg.
Roberts and Company, Inc., Bona Allen Bldg.
Arthur Neal Robinson, Sr. & Jr., 807 Henry Grady Bldg.
Sayward & Logan, Palmer Bldg.
Olof Eskil Segerberg, Box 567
Wm. W. Simmons, 896 Penn Ave., N. E.
Norman F. Stambaugh, Box 492
Jess Wilhoit, 1223 Mortgage Guarantee Bldg.

Augusta

Wm. D. Eve, Masonic Bldg.
Willis Irvin, 617-20 S. F. C. Bldg.
Scroggs & Ewing, 610 Southern Finance Bldg.

Columbus

T. F. Lockwood, 212 Murrah Bldg.

Fitzgerald

Lauren Parrott, 409 E. Central Ave.

Macon

Dennis & Dennis, Bankers Insurance Bldg.
Ellamae Ellis League, 607 Grand Bldg.
J. Burton Wilder, 122 Cleveland Ave.

Rome

Bayard L. Barnwell, Horse Leg Road

Savannah

Cletus W. Bergen, 1013 Liberty Nat'l Bank Bldg.
Levy & Clarke, 213 Liberty Nat'l Bank Bldg.

Statesboro

Walter Aldred, Jr., 38 W. Main St.

Idaho

Boise

Wayland & Fennell, 624 Idaho Bldg.

Idaho Falls

L. E. Stalker, 215 Jennie Rogers Bldg.

Nampa

Lee R. Cooke, 1220 First St., South

Pocatello

Frank H. Paradice, Jr., 219 Dietrich Bldg.

Twin Falls

Frank H. Paradice, Jr., Holmes G. Lash, 13-14 Fidelity Nat'l Bank Bldg.

Illinois

Alton

Russell O. Deeter, Alton Banking & Trust Bldg.
James M. Maupin, 515 Commercial Bldg.
Walter W. Wuellner, 115 Market St.

Aurora

Wybe J. van der Meer, 70 S. May St.

Belleville

Lyman Weisenstein, 20 N. Oak St.

Bloomington

Lundeen & Hilfinger, 601-603 Corn Belt Bank Bldg.
Schaeffer & Hooton, Peoples Bank Bldg.

Champaign

Geo. E. Ramey & Co., 415 Robeson Bldg.

Chicago

Alfred S. Alschuler & R. N. Friedman, 28 E. Jackson Blvd.
Gerald A. Barry, 4929 W. Augusta Blvd.
Herbert A. Brand, 400 W. Madison St.
Burnham & Hammond, Inc., 160 N. La-Salle St.
John Leonard Hamilton, 814 N. Tower Court
Chas. Hodgdon & Frederick Hodgdon, 111 W. Monroe St.
Holabird & Root, 333 N. Michigan Ave.
C. I. Krajewski, 225 N. Michigan Ave.
Godfrey E. Larson, Inc., 2626 W. Lunt Ave.
H. T. Liebert, 5112 N. Kenmore Ave.
Jos. C. Llewellyn Co., 38 S. Dearborn St.
Howard S. Muesse, 8 E. Huron St.
Olsen & Urbain, 8 East Huron St.
Perkins, Wheeler & Will, 2204 Merchandise Mart
Clement L. Piontek & Son, 5010 West Oakdale Ave.
Edw. A. Poynton, Dir. of Construction Office of Indian Affairs, Merchandise Mart
E. E. Roberts and Elmer C. Roberts, Inc., 22 East Huron St.
Joseph A. Slupkowski, 3024 Haussen Court
Eric G. Stenbeck, 327 So. LaSalle St.
Robert Work, 75 E. Wacker Drive

Decatur

S. A. Clausen, Standard Office Bldg.
Engineering Service Corporation, Decatur Club Bldg.
Chas. Harris, 419 Standard Office Bldg.

East St. Louis

Kennedy & Spencer, First Nat'l Bank Bldg.
Knoebel & Pabst, 609 Spivey Bldg.

Elgin

Leroy W. Thompson, 355 Congdon Ave.

Evanston

Wm. N. Alderman, 926 Michigan Ave.
Laurence P. Johnston, 1837 Wesley Ave.

Joliet

J. E. Coyle, 215 Herkimer St.

Kewanee

John A. Scribbins, 108½ N. Tremont St.

Lincoln

Deal & Deal, Box. 406, I. O. O. F. Bldg.

Metropolis

S. Lester Daly, 708 Market St.

Moline

M. R. Beckstrom, Reliance Bldg.
Wm. H. Schulzke, 5th Ave. Bldg.

Mt. Vernon

McCoy & Wilson, 1005 Main St.

Murphysboro

R. Z. Gill & Co., 1328½ Walnut St.

Peoria

Jameson & Harrison, 1014-18 Alliance Life Bldg.

Quincy

Martin J. Geise, 712½ Maine St.

Riverside

Aldrich & Aldrich, 8001 Edgewater Rd.

Rockford

Bradley & Bradley, 414 Brown Bldg.
Gilbert A. Johnson, 501 7th St.
Raymond A. Orput, 620 Empire Bldg.

Rock Island

Cervin & Stuhr, 610 Safety Bldg.
Benj. A. Horn, 506 Rock Island Bank Bldg.
Swanson & Maiwald, Cleveland Bldg.

Springfield

C. H. Hammond, Armory Bldg.
Harry J. Reiger, 403 Security Bldg.

Urbana

J. W. Royer, 108 W. Green St.
Smith, Kratz & Strong, 101 S. Broadway
Ernest L. Stouffer, 256 Administration Bldg.

Indiana

Anderson

Erwin F. Miller, 514 Anderson Bank Bldg.

Cicero

A. A. Faulstich, Box 275

Connersville

Henkel-Hanson, Thornburg Bldg.

Crawfordsville

*Carroll O. Beeson

East Chicago

Clarence I. Botteron, 4005 Main St.

Evansville

Edwin C. Berendes, 121 N. W. 4th St.
Harry E. Boyle & Co., 600 Court Bldg.
Edward J. Thole, Court Bldg.

Fort Wayne

Le Roy Bradley, 3535 St. Joseph River Drive
Albert Heeter, 2210 Lincoln Tower

Gary

Joe H. Wildermuth & Co., 527 Broadway

Hammond

L. Cosby Bernard & Co., 7241 Forest Ave.
W. S. Hutton, 5231 Hohman Ave.

Indianapolis

D. A. Bohlen & Son, 1001 Farm Bureau Bldg.
Burns & James, 333 N. Penn St.
*Herbert Foltz & Son
McGuire & Shook, 1400 Fletcher Trust Bldg.
C. Daniel J. Zimmerman & Associates, 3538 N. Meridian St.

Kentland

John A. Bruck, Box 512

Lafayette

Walter Scholer, 1114 State St.

Logansport

Henry C. Wolf, 316 Heath St.

Michigan City

Phelps & Peck, Inc., Brinkman Bldg.

Muncie

Hamilton & Graham, 411 Western Reserve Bldg.

New Albany

W. C. Findt
Hawkins & Walker, 304 Elsby Bldg.

New Castle

Ernest R. Watkins, 930 Maplewood Drive

Richmond

Werking & Son, 2000 E. Main St.

South Bend

Willard M. Ellwood, 227 Christman Bldg.
Maurer & Maurer, 101 Lincoln Way, E.
H. Roy Shambleau, 731 J. M. S. Bldg.
Ernest W. Young, 807 Sherland Bldg.

Terre Haute

Miller & Yeager, 200 Opera House Bldg.

Vincennes

Lester W. Routt, Citizens Trust Bldg.

Westport

O. W. Holmes

Iowa

Ames

Allen Holmes Kimball, 213 Eng. Annex, Iowa State College

Burlington

Robin B. Carswell, 308 F. & M. Bank Bld.

Cedar Rapids

W. J. Brown, 1962 First Ave., N. E.
Chas. B. Zalesky, 1957 Second Ave., S. E.

Davenport

Arthur H. Ebeling, 719 Kahl Bldg.
Kruse & Parish, 910 Kahl Bldg.
Seth J. Temple-Arthur Temple, 604 Putnam Bldg.

Decorah

Chas. Altfillisch, 126½ W. Water St.

Des Moines

Ralph Arnold, Bd. of Control of State Institutions, State House
Dougher, Rich & Woodburn, 310 Old Colony Bldg.
Keffer & Jones, Masonic Temple
Proudfoot Rawson-Brooks & Borg, 820 Hubbell Bldg.
Oren Thomas, 3221 Franklin
Tinsley, McBroom & Higgins, 602 Hubbell Bldg.

Forest City

Thorwald Thorson

Fort Dodge

E. O. Damon, 19 East Mason Bldg.

Iowa City

Geo. L. Horner, State University of Iowa

Mashalltown

*Russell J. Prescott, 17½ W. Main St.

Mason City

Hansen & Waggoner, 11½ S. Federal Ave.

Sioux City

Wm. Beuttler, 405-9 Insurance Exchange Bldg.
George B. Hilgers, Warnock Bldg.

Waterloo

Mortimer B. Cleveland, 424 E. 4th St.
Ralston & Ralston, 216 Waterloo Bldg.

Kansas

Abilene
Frank H. Cayton, Citizens Bank Bldg.

Chanute
E. J. Wolpert, Mercantile Bldg.

Clay Center
Hal Wheelock, 1405 Fifth St.

Emporia
A. E. Buck, 1019 Walnut St.

Hutchinson
Harold T. English, 203 W. 9th St.
Mann & Co., 902 Wiley Bldg.

Kansas City
Arthur Kriehn, 5321 Pawnee Lane

Leavenworth
Myron B. Feth, Mfrs. Bank Bldg.

Ottawa
C. A. Washburn, 220½ S. Main St.

Parsons
Gordon Shattuck

Salina
Chas. W. Shaver, 828 United Life Bldg.

Topeka
Cuthbert & Suehrk, 735 Kansas Ave.
W. E. Glover, 3101 Huntoon St.

Wichita
Forsblom & Parks, 423 Beacon Bldg.
Overend & Boucher, 1002 Brown Bldg.
Lorentz Schmidt, 1832 E. 2nd St.
Glen H. Thomas, 125½ N. Topeka Ave.

Winfield
Wm. N. Caton, 808 Loomis St.

Kentucky

Frankfort
C. Julian Oberwath, 301 2nd St.

Hazard
H. A. Spalding, Box 569

Hopkinsville
John T. Waller, 205 E. 17th St.

Lexington
Frankel & Curtis, 572 McClelland Bldg.
John T. Gillig, 234 E. Short St.
Hugh Meriwether, 236 E. Short St.
John F. Wilson, 145 E. High St.

Louisville
E. T. Hutchings, 1722 Heyburn Bldg.
Joseph & Joseph, 647 S. 3rd St.
D. X. Murphy & Bro., 707 Louisville Trust Bldg.
Thos. J. Nolan & Son, Kentucky Home Life Bldg.
*W. Earle Otis, Thurman Apts.—D-1
Arthur G. Tafel, 140 S. 3rd St.

Owensboro
Walter Scott Roberts, Sherman-Coffman Bldg.

Louisiana

Alexandria
*Herman J. Duncan & Co., 1930 Polk St. (also in New Orleans)
Max J. Heinberg, Box 1694

Baton Rouge
Bodman & Murrell, Reymond Bldg.
Robert H. Goodman, 215 Wieck Bldg.
George Anthony Thompson, 424 State St.

Lafayette
Favrot & Reed & Frederick J. Nehrbass, Associates, 123 Edgewood Terrace

Lake Charles
Dunn & Quinn, P. O. Box 483, 827 Hodges St.

New Orleans
Wm. R. Burk, 1731 Plum St.
Edgar A. Christy, Orleans Parish School Bd., 703 Carondelet St.
Diboll-Kessels & Associates, 1005 Baronne Bldg.
Favrot & Reed, 402 Nola Bldg.
Moise H. Goldstein & Associates, 812 American Bank Bldg.
Jones, Roessle & Olschner, 810 Maison Blanche Bldg.
Wm. T. Nolan, 710 Queen & Crescent Bldg.
Carl L. Olschner, 311 Pere Marquette Bldg.
Allison Owen, 301 Pere Marquette Bldg.
Wogan & Bernard, 802 Baronne Bldg.

Shreveport
Stanley Brown, 439 Washington St.
Samuel G. Wiener, Commercial National Bank Bldg.

Maine

Auburn
Alonzo J. Harrriman, 88 Shepley St.

Bangor
Crowell & Lancaster, 6 State St.

Maryland

Baltimore
O. Eugene Adams, 329 N. Charles St.
James R. Edmunds, Jr., 409 Calvert Bldg.
William W. Emmart, 1818 Munsey Bldg.
Bernard Evander, 6108 Stuart Ave.
Lucien E. D. Gaudreau, Baltimore Trust Bldg.
David Harrison, 421 St. Paul Place
Henry Powell Hopkins, 10 E. Mulberry St.
Harry L. Katz, 3212 Gwynns Falls Park
Hal A. Miller & Associates, 421 St. Paul Place
Frederick L. W. Moehle & Associates, 319 Professional Bldg.
Palmer & Lamdin, 1020 St. Paul St.
John H. Scarff, 213 Keyser Bldg.
Thurman & May, 2605 Baltimore Trust Bldg.
Taylor & Fisher, 1012 N. Calvert St.

College Park
J. Raymond Mims, 4505 Calvert Road

Hagerstown
A. J. Klinkhart, Franklin Court

Hyattsville
Ross & Walton, 5223 Baltimore Ave.

Salisbury
Edwin Wilson Booth, Box 888
Malone & Williams

Silver Spring
*Brown Ralston, 1513 E. Falkland Lane

Takoma Park
Ronald Senseman, 1100 Carroll Ave.

Massachusetts

Belmont
Coolidge & Carlson, 31 Howells Rd.

Boston
Andrews, Jones, Biscoe & Whitmore, 50 Congress St.
Appleton & Stearns, 53 State St.
J. Williams Beal, Sons, 185 Devonshire St.
Francis D. Bulman, 1078 Boyston St.
Coolidge, Shepley, Bulfinch & Abbott, 1 Court St.
Desmond & Lord, 6 Beacon St.
M. A. Dyer Co., 8 Beacon St.
Chas. R. Greco, Inc., 11 Beacon St.
Hutchins & French, 11 Beacon St.
Kilham, Hopkins & Greeley, 126 Newbury St.
Leland & Larsen, 20 Providence St.
Markus & Nocka, 184 Boyston St.
McLaughlin & Burr, 60 Congress St.
Perry, Shaw & Hepburn, 141 Milk St.
*Isidor Richmond, 248 Boyston St.
James H. Ritchie & Associates, 20 Newbury St.
Louis Warren Ross, 20 Kilby St.
Richard Shaw, 25 Huntington Ave.
Shepard & Stearns, 65 Franklin St.

Cambridge
Walter Gropius, 1430 Massachusetts Ave.

Fall River
Israel T. Almy, 56 N. Main St.
E. M. Corbett, 49 Purchase St.

Fitchburg
S. W. Haynes & Associates, 336 Main St.

Greenfield
Jas. A. Britton, 20 Federal St.

Haverhill
Clinton F. Goodwin, 25 Washington Sq.

Lawrence
Ashton & Huntress, 477 Essex St.

Leominster
Harold E. Mason, 15 Prospect St.

Milton
Frank Irving Cooper Associates, 554 Pleasant St.

Newton
Edmund I. Leeds, 193 Tremont St.

Northampton
Frank Mark Mahoney, 45 Beacon St., Florence

Norwood
H. Korslund, 153 Nahatan St.
Wm. G. Upham, 698 Washington St.

Springfield
Morris W. Maloney, 220 Dwight St.

Worcester
O. E. Nault & Sons, 48 Hamilton St.

Michigan

Battle Creek
A. B. Chanel, 9 Merwood Drive
Lewis J. Sarvis, 201 Bailey Bldg.

Bay City
Jos. C. Goddeyne, Bay City Bank Bldg.

Berrien Springs
Alfred P. Allen, R. R. 2

Birmingham
Saarinen & Swanson, 309 Wabeek Bldg.

Dearborn
Bennett & Straight, 201 Schaefer Bldg.
Harry C. Vicary, 22148 Michigan Ave.

Detroit
Leo M. Bauer, 534 Free Press Bldg.
Derrick & Gamber, Inc., 515 Hammond Bldg.
Geo. F. Diehl, 120 Madison St.
J. Ivan Dise, 2631 Woodward Ave.
Giffels & Vallet Inc., 1000 Marquette Bldg.
Jensen & Keough, 3757 Gladstone Ave.
Lane-Davenport-Meyer, 806 Farwell Bldg.
McGrath & Dohmen, 2631 Woodward Ave.
Malcolmson, Calder & Hammond, Inc., 1217 Griswold St.
G. M. Merritt & Lyle S. Cole, 1111 Collingwood Ave.
C. Wm. Palmer, 409 Griswold St.
Suren Pilafian, 112 Madison Ave.
Edw. A. Schilling, 409 Griswold St.
Geo. L. W. Schulz, 1354 B'way
Shreve, Anderson & Walker, Marquette Bldg.
Smith, Hinchman & Grylls, Inc., 800 Marquette Bldg.
Eberle M. Smith, 208 Murphy Bldg., Highland Park
N. Chester Sorenson Co., 2201 Industrial Bank Bldg.
B. C. Wetzel & Co., 4643 Pacific Ave.

Flint

Geo. J. Bachman, 6481 Branch Rd.

Grand Rapids

Roger Allen, 1228 Grand Rapids National Bank Bldg.
Knecht, McCarty & Thebaud, Inc., Watson Bldg.

Kalamazoo

Louis C. Kingscott & Associates, Inc., 208 Elm St.

Lansing

Lee Black & Kenneth C. Black, 706 Capitol Savings & Loan Bldg.
Bowd & Munson, 409 Wilson Bldg.
Herrick & Simpson, 1003 Bauch Bldg.
Warren S. Holmes Co., 2300 Olds Tower Bldg.

Marquette

David E. Anderson, 301 Nester Block

Midland

Alden B. Dow, Post St.

Menominee

Derrick Hubert, 1065 Sheridan Road

Midland

Henry H. Turner, 220 W. Main St.

Port Huron

Walter H. Wyeth, 323 Peoples Bank Bldg.

Royal Oak

Frank D. Madison, 230 Wayne Oakland Bank Bldg.

Saginaw

Frederick Beckbissinger, 304 Carroll St.
Donald A. Kimball, 2345 Delaware Blvd.

St. Johns

R. V. Gay, 1½ Clinton Ave.
St. Clair Pardee, 703 S. Oakland St.

Traverse City

Ralph L. Bauer, 402 State Bank Bldg.

Wayne

Brender & Van Reyendam, 35449 Annapolis St. (Box 712)

Ypsilanti

R. S. Gerganoff, 206 N. Washington St.

Minnesota

Alberta Lea

LeRoy Gaarder, 701 Fountain St.

Duluth

Erickson & Co., 1911 E. 2nd St.
Giliuson & Ellingsen, 611 Torrey Bldg.
A. Reinhold Melander, 603 Alworth Bldg.
Thos. J. Shefchik, 307 Lonsdale Bldg.
C. H. Smith, 909 Torrey Bldg.

Fergus Falls

*Foss & Co., 415 South Mill

Mankato

Pass & Rockey, 124½ E. Jackson St.

Minneapolis

Walter R. Dennis, 1108 Nicollet Ave.
E. H. Enger, Bd. of Education, 305—City Hall
Haxby & Bissell, 1111 Nicollet Ave.
Jacobson & Jacobson, 623 Sexton Bldg.
Lang & Raugland, 502 Wesley Temple Bldg.
Larson & McLaren, Foshay Tower
Allan H. Meinecke, 1318 7th St., S. E.
Pesek & Shifflet, 914 Marquette Ave.
Edmund J. Prondzinski, 240 Plymouth Bldg.

St. Cloud

Frank W. Jackson, 405 2nd Ave.
Louis C. Pinault

St. Paul

Frank A. Abrahamson, 594 Endicott-on-Robert
Wm. L. Alban, 347 Endicott Bldg.
P. C. Bettenburg & Co., 1437 Marshall Ave.
Carl H. Buetow, 570 N. Snelling Ave.
Clarence H. Johnston, Empire Bank Bldg.
Jas. C. Niemeyer, 419 New York Bldg.
Slifer & Cone, 442 Endicott Bldg.
Toltz, King & Day, Inc., 1509 Pioneer Bldg.

Winona

Boyum, Schubert & Sorenson (also in La Crosse, Wis.)

Mississippi

Biloxi

John T. Collins, Fayard Bldg.

Gulfport

Shaw & Woleben, Salloum Bldg.
Vinson B. Smith, Jr., Hewes Bldg.

Hattiesburg

Landry & Matthes, 218 W. Pine St.

Jackson

Fort & White, Guaranty Bank Bldg.
Emmett J. Hull, 825 Belhaven St.
E. L. Malvaney, Millsaps Bldg.
R. W. Naef, 536 Eastview
Jas. M. Spain, 813 Deposit Guaranty Bldg.

Meridian

Krouse & Brasfield, 204 Kidder Bldg. (Box 1065)

Pascagoula

J. Warren McCleskey, 802 Washington Ave. (Box 66) (also in Hattiesburg, Miss.)

Missouri

Cape Girardeau

J. Carl Jourdan, 1010 Themis

Jefferson City

Louis Edwin Fry, 411 Lafayette St.

Kansas City

Carroll & Dean, 1220 R. A. Long Bldg.
Edw. M. Fuller, Briercliff Rd., R. R. No. 4, North Kansas City
Frederick C. Gunn, 412 W. 62 St.
Hardy & Schumacher, 410 Scarritt Arcade Bldg.
Keene & Simpson, 15 W. 10 St.
Marshall & Brown, 114 West 10 St.
H. D. Pampel, 304 Finance Bldg.
William H. Sayler, 1207 Grand Ave.
Jos. B. Shaughnessy, 416 Reliance Bldg.
Chas. A. Smith, 800 Finance Bldg.
Richard N. Wakefield, 1012 Baltimore Ave.
Wight & Wight, 14 W. 10 St.

Moberly

Ludwig Abt, Riegel Bldg.

St. Joseph

Eckel & Aldrich, 1105 Corby Bldg.
Everett Johns, 402 Empire Trust Bldg.
Eugene R. Meier, Bartlett Bldg.

St. Louis

Macon A. Abbitt, 315 N. 7th St.
Bonsack & Pearce, Inc., 408 Olive St.
Marcel Boulicault, 1401 Ambassador Bldg.
Ernest T. Friton, Security Bldg., 4th & Locust Sts.
Hugo K. Graf, 2825 Olive St.
Henry P. Hess, 7th & Locust St., 1001 Ambassador Bldg.
P. John Hoener, 3415 S. Kingshighway
Wm. B. Ittner, Inc., 911 Locust St.
Jamieson & Spearl, 1696 Arcade Bldg.
La Beaume & Klein, 315 N. 7th St.
Murphy & Wischmeyer, 911 Locust St.
P. M. O'Meara & Associates, 5709 Waterman Ave.

Springfield

Earl Hawkins, 402 E. Elm St.
Johnson & Robinett, 1042 Landers Bldg.

Montana

Billings

Chandler C. Cohagen, 211 Hedden Bldg.
Cushing & Terrell, 211 Hedden Bldg.
J. C. Link & Co., 317 Electric Bldg. (Box 1313)
Edwin G. Osness, 2714 10th Ave., N.

Bozeman

Fred F. Willson, Box 497

Great Falls

Cottier & Herrington, First Nat'l Bank Bldg.
A. V. McIlver, Box 1945
Geo. Shanley, 315 First Nat'l Bank Bldg.

Havre

Frank F. Bossuot, 133 4th Ave.

Kalispell

Fred A. Brinkman, Whipps Block

Missoula

C. J. Forbis & C. G. Forssen, Montana Bldg.
H. E. Kirkemo, Lehsou Block

Nebraska

Kearney

McClure & Walker, 2111½ Central Ave.

Lincoln

Davis & Wilson, 757 Stuart Bldg.
N. Bruce Hazen, 305 Stuart Bldg.
Meginnis & Schaumberg, 614 Federal Securities Bldg.
J. F. Reynolds, 1637 S. 11th St.
John Unthank, 1410 Sharp Bldg.

Norfolk

James C. Stitt, 315 Norfolk Ave.

North Platte

C. C. Coursey, Room 14, Neville Bldg.

Omaha

N. R. Brigham, Keeline Bldg.
Everett S. Dodds, 6601 Florence Blvd.
Lahr & Stangel, W. O. W. Bldg.
John Latenser & Sons, Inc., 1307 Farnham St.
John McDonald & Alan McDonald, 604 Standard Oil Bldg.
Chas. W. Steinbaugh, 105 Park Ave.

Scottsbluff

O. J. Hehnke, 213 E. 16 St. (Box 516)

Nevada

Reno

DeLongchamps & O'Brien, Gazette Bldg.
Gulling & Means, Clay Peters Bldg.

New Hampshire

Durham

E. T. Huddleston, University of New Hampshire

Hanover

Jens Frederick Larson, 27 E. Wheelock St.
Alfred T. Granger, Musgrove Bldg.

Portsmouth

M. E. Witmer, 3 Hillside Drive.

New Jersey

Camden

Jos. Norman Hettel, 501 Cooper St.
F. Herbert Radey, 101 N. 7th St.

Elizabeth

Leslie M. Dennis, 939 Harding Rd.

Englewood

Lawrence C. Licht, 19 Knickerbocker Rd.

Fort Lee
Hacker & Hacker, Ft. Lee Trust Co. Bldg.

Hackensack
C. V. R. Bogert, 210 Main St.

Hazlet
Frederic Fessler, Keyport-Holmdel Rd.

New Brunswick
Alexander Merchant & Son, 1 Elm Row

Paterson
Fanning & Shaw, 49 Ward St.
*James Holt

Pitman
Harry T. Morgan, 144 Cyrus Ave.

Plainfield
Ernest Thornell Brown, 201 E. 5th St.
Alfred M. Korff, 203 Park Ave.

Trenton
Louis S. Kaplan, 33 W. State St.
Wm. W. Slack & Son, 1401 W. State St.

Union
Frederick A. Elsasser, 1000 Stuyvesant Ave.

Waldwick
Geo. Nordham, 67 E. Prospect St.

West Englewood
Harry Lucht, 1700 Teaneck Road

West New York
Frank J. Ricker, 6115 Hudson Ave.

Woodbury
Harold M. Klaisz, 7 Maple St.

New Mexico

Albuquerque
*Brittelle & Ginner, 907 Parkland Circle
Louis G. Hesselden, 403 N. 12th St.

Clovis
Robert E. Merrell, Box 852
Jerry M. Schaefer, 1208 Pile St. (Box 667)

Roswell
Voorhees & Standhardt, 109½ N. Main St.

Santa Fe
W. C. Kruger, Box 308
John Gaw Meem, Hugo Zehner and Associates, Box 628

New York

Albany
H. O. Fullerton, 152 Washington Ave.
Gander, Gander & Gander, 17 Steuben St.
Thomas L. Gleason, 563 Morris St.
Office of Walter P. R. Pember, 24 James St.
J. Russell White, 109 State St.

Amsterdam
Howard F. Daly, 15 E. Main St.

Auburn
Wallace P. Beardsley, 96 Genesee St.

Binghamton
Conrad & Cummings, 99 Collier St.
A. T. Lacey & Sons, 52 Exchange St.

Bridgehampton
John Muller, Ocean Rd.

Brooklyn
Eric Kebbon, Supt. of School Bldgs., Bureau of Construction, 49 Flatbush Avenue Extension
Jos. Mathieu, 16 Court St.
Henry V. Murphy, 1 Hanson Place

Buffalo
Daniel G. McNeil, 1080 Parkside
Earl Martin, 187 Niagara St.
Roswell E. Pfohl, 187 Niagara St.

Cortland
Carl W. Clark, State Theatre Bldg.

Fayetteville
Gordon Wright, 315 E. Genesee St.

Herkimer
R. E. Sluyter, 203 Washington St.

Jamestown
Beck & Tinkham, 30 Bailey Bldg.
R. A. Freeburg, 1105 W. 3 St.

Kingston
Teller & Halverson, 280 Wall St.

Middletown
Robert R. Graham, 25 Prospect St.

New York City
*Adams & Prentice
Grosvenor Atterbury, 139 E. 53 St.
Wesley Sherwood Bessell, 16 E. 50 St.
Wm. J. Boegel, 516 5th Ave.
Henry O. Chapman & Randolph Evans, 140 Nassau St.
Coffin & Coffin, 125 E. 46 St.
Harvey W. Corbett, 300 4th Ave.
Crow, Lewis & Wick, 200 5th Ave.
Arthur E. Dore, 101 Park Ave.
Eggers and Higgins, 542 5th Ave.
Aymar Embury, II, 150 E. 61 St.
Wm. Gehron, 101 Park Ave.
Archibald F. Gilbert, 358 5th Ave.
Harrison, Fouilhoux & Abromovitz, 45 Rockefeller Plaza
Wm. E. Haugaard, Commissioner of Architecture, Div. of Architecture, 80 Centre St.
Edw. Shephard Hewitt, 32 E. 57 St.
Alfred Hopkins & Associates, 415 Lexington Ave.
Thos. H. Irving, 261 Broadway
Louis E. Jallade, 597 5th Ave.
A. H. Knappe & Associates, 192 Lexington Ave.
Kohn & Butler, 56 West 45 St.
Archibald G. Lamont, 156 5th Ave.
William Lescaze, 211 E. 46 St.
B. Francis McGuire, 466 Lexington Ave.
McKim, Mead & White, 101 Park Ave.
Frederick Mathesius, 103 Park Ave.
Mayer & Whittlesey, 31 Union Square
Moore & Hutchins, 11 E. 44 St.
Morris & O'Connor, 101 Park Ave.
John Muller, 10 E. 40 St.
Robert J. Reiley, 62 W. 45 St.
James Gamble Rogers, Inc., 156 E. 46 St.
Shreve, Lamb & Harmon, 11 E. 44 St.
Sloan & Behrens, 420 Lexington Ave.
Starett & Van Vleck, 267 5th Ave.
Stearns and Stanton, 160 5th Ave.
Tooker & Marsh, 101 Park Ave.
Wm. B. Tubby, 444 Madison Ave.
Hobart Upjohn, Rm. 5952, Grand Central Terminal
Van der Gracht & Kilham, 211 E. 49 St.
Theodore Visscher & James Burley, 51 E. 42 St.
Voorhees, Walker, Foley & Smith, 101 Park Ave.
Franklin B. Ware, 1170 Broadway
Chas. A. William & Geoffrey Platt, 101 Park Ave.

Olean
A. W. E. Schoenberg, First Nat'l Bank Bldg.

Orchard Park
Paul H. Harbach, 250 E. Quaker St.

Plattsburg
Alvin W. Inman, 45 Cumberland Ave.

Richfield Springs
Myron A. Jordan, Main St.

Rochester
Carl C. Ade, 80 East Ave.
C. Storrs Barrows, 43 Main St. E.
Chas. A. Carpenter, 325 Genesee Valley Trust Bldg.
Dryer & Dryer, 2550 East Ave.
Wm. G. Kaelber & L. A. Waasdorp, 311 Alexander St.
Geo. F. Lorenz, 3086 St. Paul Blvd.
Francis R. Scherer, Bd. of Education, 13 S. Fitzhugh St.
Smith & Stickney, 154 East Ave.

Rome
F. W. Kirkland, American Block—N. James St.

Scarsdale
Harold G. Webb, 20 Forest Lane

Syracuse
Paul Hueber, 224 Harrison St.
Melvin L. & Harry A. King, 300 Denison Bldg.
Randall & Vedder, 705 S. A. & K. Bldg., 206 East Genesee St.
D. Kenneth Sargent, 200 Syracuse-Kemper Bldg.

Utica
Bagg & Newkirk, 258 Genesee St.
Edward J. Berg, 704 Washington St.

Valley Stream
Frederick P. Wiedersum, 240 Rockaway Ave.

Watertown
Office of David D. Kieff, C. of C. Bldg.
Lansing, Greene & Bisnet, 406 Trust Bldg.

West Hempstead
W. H. Spaulding, 22 Stevens Ave.

Wyandach
Hugo H. Avolin, Belmont Road

North Carolina

Asheville
S. Grant Alexander & Associates, 205 College St.
Henry Irven Gaines, 501 Public Service Bldg.
Lindsey M. Gudger, 52 Carter St.

Black Mountain
A. Lawrence Kocher, Black Mountain College

Charlotte
Walter W. Hook, 1204 Commercial Bldg.

Elkin
J. M. Franklin, Box 28

Goldsboro
A. J. Maxwell, Jr., 509 Borden Bldg.

Greensboro
W. L. Brewer, 503 Dixie Bldg.
Chas. C. Hartman, 120 Jefferson Bldg.
Joseph J. Sawyer, 129 S. Mendenhall St.
Albert C. Woodroof, 833 Jefferson Bldg.

Henderson
Eric G. Flannagan, McCoin Bldg.

Hendersonville
Erle G. Stillwell, Inc., Box 1056

Kinston
John J. Rowland, 330 N. Queen St.

Leaksville
Jas. W. Hopper, 234 W. Washington St.

Leonoir
Clarence P. Coffey & Bernard Olson, 301 Hedrick Bldg.

Louisberg
M. Stuart Davis, Nat'l Bank Bldg.

New Bern
Raymond Fuson, Elks Temple Bldg.

Raleigh
Wm. Henley Deitrick, 115 W. Morgan St.
Ross Shumaker, Box 5445

Wilmington
Lynch & Foard, 202½ Princess St.

Wilson
Frank W. Benton, Municipal Bldg.
Thos. B. Herman, 117 W. Nash St.

Winston Salem
Northrup & O'Brien, Reynolds Bldg.
Wm. Roy Wallace, 1202 Reynolds Bldg.

North Dakota

Fargo
Braseth & Houkom, 716 S. 7th St.
Knute A. Henning, 1103 N. 2nd St.
Wm. F. Kurke, 1117 13th Ave., N.

Jamestown
Gilbert R. Horton, No. 1 Country Club Rd.

Minot
E. W. Molander, 508 First Ave. Bldg.
Ira L. Rush, R. F. D. No. 4

Ohio

Akron
Leroy W. Henry, 335 Hillwood Drive
M. M. Konarski, 1100 Merriman Rd.
Wm. Boyd Huff, 640 N. Main St.
M. P. Lauer, 31 N. Summit St.

Ashtabula
Clarence V. Martin, 202 Johnson Bldg.

Athens
Wm. J. Davis, Security Bank Bldg.

Berea
Mellenbrook, Foley & Scott, 26 Front St.

Bowling Green
S. P. Stewart & Son, 135 W. Wooster St.

Canton
Chas. E. Firestone & Laurence J. Motter, 1412 Cleveland Ave., N. W.
Harry C. Frank, 203 Market Ave., So.

Cincinnati
Chas. Frederick Cellarius, 906 St. Paul Bldg.
Felsberg & Gillespie, 2164 Harrison Ave.
Grunkemeyer & Sullivan & Associates, 3717 Eastern Ave.
E. C. & G. T. Landberg, 114 Garfield Pl.
Potter, Tyler & Martin, 35 E. 7th St.
Edward J. Schulte, 920 E. McMillan St.

Cleveland
Walter G. Caldwell, 838 Engineers Bldg.
Geo. Fox, 1936 Union Commerce Bldg.
Harry A. Fulton, 5716 Euclid Ave.
Walker & Weeks, 1240 Huron Rd.

Cleveland Heights
R. A. Curry, 2472 Overlook Rd.
Wm. Koehl, 3091 Mayfield Rd.

Columbus
John Quincy Adams, 35 South Champion St.
J. Fred Fornoff, 55 E. State St.
F. F. Glass, 20 S. 3rd St.
Edw. Kromer, Bd. of Education, 270 E. State St.
Howard Dwight Smith, 1950 Arlington Ave.
Claude W. Youst, 55 E. State St.

Coshocton
Fred D. Jacobs, 514 Main St.

Dayton
Rial T. Parrish, 1703 U. B. Bldg.
Albert & Freeman A. Pretzinger, 1155 Reibold Bldg.
Walker, Norwick & Templin, 1301 American Bldg.

Elyria
Silsbee & Smith, 39 Turner Bldg.

Forest
Burk & Seebach, Warner St.

Fremont
C. H. Shively, 400½ Croghan St.

Hamilton
Geo. Barkman, 20 N. 6th St.

Lancaster
Ralph E. Crook

Lima
Thos. D. McLaughlin & Associates, 500 Dominion Bldg.

Mansfield
Althouse & Jones, Farmers Bank Bldg.
Vernon Redding & Associates, 616 Walpark Bldg.

Marion
Moore & Denman, 132 E. Center St.

Nelsonville
Wm. Mills & Son, Citizens Central Bank Bldg.

Newark
Merle T. Orr, 77 Granville St.

Norwalk
Granville E. Scott, Citizens Nat'l Bank Bldg.

Portsmouth
Devoss & Donaldson, National Bank Bldg.

Sandusky
Harold Parker, 230 E. Market St.

Sidney
F. E. Freytag, Orbison Hill

Steubenville
Fred H. Clarke, 1002 National Exchange Bank Bldg.

Tiffin
Lynn Troxel, 201 Laird Bldg.

Toledo
Britsch & Munger, 1025 Nicholas Bldg.
Hahn & Hayes, 723 Adams St.
Jokel-Coy-Thal, 320 Ontario St.
Mills, Rhines, Bellman & Nordhoff, Inc., 518 Jefferson Ave.

Warren
Keich & O'Brien, 912 Union Savings & Trust Bldg.

Youngstown
Myron N. Goodwin & P. Arthur D'Orazro, Associates, 302 Union Nat'l Bank Bldg.
O. J. Kling, 100 E. Rayen Ave.
M. Gilbert Miller, 12 West Madison Ave.

Oklahoma

Bartlesville
J. Arthur Gorman, Box 772
Chas. Woodruff, 1024 Jennings St.

Chickasha
Paul Harris, Box 613

Enid
R. W. Shaw, 716 Bass Bldg.

Muskogee
H. H. Niemann, 1155 Summit St.

Oklahoma City
Leonard H. Bailey, 1217 Colcord Bldg.
Forrest Butler, 613½ W. 19 St.
Dennis E. Donovan, 618 N. W. 23 St.
Hudgins, Cobb, Thompson & Ball, 919 Cotton Exchange Bldg.
Noftsger & Lawrence, 2507 N. W. 23rd St.
Parr & Aderhold, 1200 Belford Ave.
Sorey, Hill & Sorey, 2602 First Nat'l Bldg.
Walter T. Vahlberg, 1221 Perrine Bldg.
Winkler & Reid, 612 Oklahoma Savings Bldg.

Spavinaw
A. J. Love & Co.

Stillwater
Philip A. Wilber, 315 Knoblock St.

Tulsa
A. M. Atkinson, Thompson Bldg.
Ralph M. Black, 342 Kennedy Bldg.
John O. Bradley, 215 E. 13 Place
Jos. R. Koberling, 1400 S. Boston Ave.
Frank C. Walter, 1231 S. Zunis Ave.

Oregon

Astoria
J. E. Wicks, 515 Commercial St.

Eugene
Graham B. Smith, Register-Guard Bldg.

Medford
Wm. Laing, 303 U. S. Nat'l Bank Bldg.

Portland
Annand & Kennedy, 414 Central Bldg.
Barrett & Logan, 1940 S. W. 4th Ave.
Pietro Belluschi, 2040 S. W. Jefferson
C. N. Freeman, 304 Postal Bldg.
Margaret G. Fritsch, 428 Railway Exch. Bldg.
Francis B. Jacobberger, 505 McKay Bldg.
Hollis Johnston, 407 Railway Exchange Bldg.
Jones and Marsh, Woodlark Bldg.
Ellis F. Lawrence, 918 Failing Bldg.
Howard R. Perrin, 154 N. W. Maywood Drive
Truman E. Phillips, Pearson-Fourth Ave. Bldg.
Roald & Schneider, 1009 Spalding Bldg.
F. Marion Stokes, 205 Hughes Bldg.

Salem
Lyle P. Bartholemew, Pioneer Trust Bldg.

Pennsylvania

Allentown
H. F. Everett & Associates, 723 Commonwealth Bldg.
Ruhe & Lange, 12 N. 6th St.
Geo. E. Yundt, 16 S. 6th St.

Altoona
Hunter & Caldwell, 3601 Fifth Ave.

Bethlehem
Lovelace & Spillman, 103 W. Broad St.

Bradford
Thos. K. Hendryx, 165 Interstate P'kway

Charleroi
Alan C. Brenton, 407 Lincoln Ave.

Clarks Green
Emerson Willson, 610 Glenburn Rd.

Donora
C. C. & E. E. Compton, 4th St. & Thompson Ave.

Doylestown
Fred F. Martin, 14 Hart Bldg.

Ellwood City
B. J. McCandless, 239 Fourth St.

Erie
Clement S. Kirby, 606 Commerce Bldg.

Walter T. Monahan, 406 Marine Bank Bldg.
Myers & Johnson, 821 Commerce Bldg.
G. W. Stickle, 121 E. 9th St.

Esterly

Elmer H. Adams

Greensburg

Sorber & Hoone, 710 First Nat'l Bank Bldg.

Harrisburg

Lawrie & Green, 111 S. Front St.
Jas. W. Minick, 503 N. 2nd St.
Jos. Lesher Steele, 219 Walnut St. (also Lebanon, Pa.)

Homestead

Adam G. Wickerham, 135 E. 8th Ave.

Johnstown

Horace A. Bailey, 209 Franklin St.
H. B. Raffensperger, 1 Jefferson St.

Kittanning

Tillman Scheeren, Jr., Boarts Bldg.

Lancaster

Ross W. Singleton, 442 Woolworth Bldg.

Lewisburg

Malcolm A. Clinger, 222 Market St.

McKeesport

Chas. R. Moffitt, Masonic Temple Bldg.

Monessen

H. Ernest Clark, 725 2nd St.

Mount Carmel

Henry J. Socoloskie, 310 S. Hickory St.

New Castle

W. G. Eckles Co., Lawrence Savings & Trust Bldg.
The Thayer Co., Greer Bldg.

Norristown

*Henry Gordon McMurtrie, Airy & Stanbridge Sts.

Philadelphia

Horace W. Castor, 1518 Walnut St.
Henry D. Dagit & Sons, 1329 Race St.
Davis & Dunlap, 1717 Sansom St.
Thos. J. Earley, 1701 Walnut St.
Frank E. Hahn, Inc., 1511 W. Oxford St.
Heacock & Platt, 152 N. 15th St.
Walter T. Karcher & Livingston Smith, 1520 Locust St.
The Office of Chas. Z. Klauder, 1429 Walnut St.
W. H. Lee, 1505 Race St.
Sidney E. Martin, 1700 Walnut St.
G. W. Pepper, Jr., 1600 Walnut St.
Savery, Scheetz & Gilmour, 1520 Locust St.
Howell Lewis Shay, 1701 Packard Bldg.
Geo. Franklin Sook, 3338 W. Penn St.
Office of Horace Trumbauer, Julian F. Abele & Wm. O. Frank, 1410 Land Title Bldg.
Wenner & Fink, 1701 Arch St.
Stanley Yocum, Bd. of Public Education, Parkway at 21st St.

Pittsburgh

L. H. Button & P. McLean, 119 E. Montgomery Ave.
Carlisle & Sharrer, 507 Martin Bldg.
Jos. Hoover, 1408 Keystone Bldg.
J. Lawrence Hopp, 400 Hazel Drive
Kaiser, Neal & Reid, 324 Fourth Ave.
Leo A. McMullen, 900 Renshaw Bldg.
Casmir J. Pellegrini, 201 S. Craig St.
John H. Phillips, 715 Wabash Bldg.
A. Pyzdrowski, 3410 Fleetwood St.
Chas. M. & Edward Stotz, Jr., 801 Bessemer Bldg.

Pottsville

Philip G. Knobloch, 1811 W. Market St.

Reading

W. Marshall Hughes, 147 N. 5th St.
Muhlenberg, Yarkes & Muhlenberg, Ganster Bldg., 5th & Walnut Sts.
Ritcher & Eiler, 147 N. 5th St.

Scranton

Coon & Barrett, Scranton Nat'l Bank Bldg.
Hancock & Willson, Mears Bldg.

State College

Dean E. Kennedy, Route 322

Stroudsburg

Rinker & Kiefer, 7th & Main Sts.

Uniontown

Emil R. Johnson, 24 Robinson Ave.

Upper Darby

*Gondos & Gondos

West Chester

Frederick F. Mills, R. D. 5

Wilkes-Barre

Thos. A. Foster, Brooks Bldg.
Fred J. Mack, 22 N. Franklin St.
Austin L. Reilly, 54 Bennett Bldg.

Wilkinsburg

Walter E. Schardt, 811 Pitt St.

Williamsport

R. Douglas Steele, 816 Northway Rd.

York

Office of John B. Hamme, 31 W. Market St.
Harry R. Lenker, Schmidt Bldg., Continental Square

Rhode Island

Apponaug

Edward O. Ekman, 60 Natick Ave., Greenwood

Pawtucket

Albert H. Humes, 38 Beech St.

Providence

Albert Harkness, 6 Cooke St.
*B. G. V. Zetterstrom, 22 Delmar Ave.

Woonsocket

Walter F. Fontaine, Inc., 285 Main St.

South Carolina

Anderson

Chas. Wm. Fant, 109½ Sharpe St.

Charleston

James D. Benson, 21 Church St.
Simons & Lapman, 17 State St.

Columbia

Heyward S. Singley, 1508 Washington St.

Florence

Hopkins & Baker, Florence Trust Bldg.

Greenville

Cunningham & Walker, 27 W. McBee Ave.
J. E. Sirrine & Co., 215 S. Main St.

Rock Hill

A. D. Gilchrist, 933 College Ave.

Spartanburg

W. Paul Williams, 256 Oakland Ave.
Harold E. Woodward, 18 Harris Bldg.

W. Columbia

Jesse W. Wessinger, 701 Meeting St.

South Dakota

Aberdeen

J. W. Henry, First Nat'l Bank Bldg.

Huron

F. C. Kuehn, Masonic Temple Bldg.

Mitchell

Walter J. Dixon, 204 Medical Arts Bldg.

Pierre

Dean W. Loucks, Capitol Bldg.

Rapid City

James C. Ewing, 609 Main St.
Adrian L. Forete, 1113 St. James

Sioux Falls

Perkins & McWayne, 320 Paulton Bldg.
Harold Spitznagel, 310 Western Surety Bldg.

Tennessee

Alcoa

D. E. Caulton

Bristol

R. V. Arnold, 539 Alabama St.

Chattanooga

Selmon T. Franklin, 714 Lindsey St.
R. H. Hunt Co., 1225 James Bldg.
W. H. Sears & P. B. Shepherd, 802 James Bldg.
Gordon L. Smith, Volunteer State Life Bldg.

Clarksville

Speight & Hibbs, Public Square

Johnson City

D. R. Beeson, Sells Bldg.

Kingsport

Allen N. Dryden, Improvement Bldg.

Knoxville

Barber & McMurry, 517½ W. Church Ave.
Fred Manley Associates, 720 Market St.

Memphis

Geo. Awsumb, 1792 Forrest Ave.
Hanker & Heyer, 1036 Commerce Title Bldg.
W. C. Jones, Sr. & W. C. Jones, Jr., 1167 Shrine Bldg.
Geo. Mahan, 1614 Sterick Bldg.
Estes W. Mann, 967 Shrine Bldg.
Walter R. Nelson, 2115 Monroe Ave.
Regan & Weller, Commerce Title Bldg.
Raymond B. Spencer, John R. Sanford, Associate, First Nat'l Bank Bldg.
Everett Woods, Sterick Bldg.

Nashville

Thos. W. Gardner, 1502 American Trust Bldg.
Hart, Freeland & Roberts, 926 Third Nat'l Bank Bldg.
Henry C. Hibbs, 1505 American Trust Bldg.
Granbery Jackson, Jr., Norwood Drive
Marr & Holman, 702 Stahlman Bldg.
McKissack & McKissack, Morris Memorial Bldg.
Geo. D. Waller, 832 Third Nat'l Bank Bldg.
Warfield and Keeble, Nashville Trust Bldg.
Emmons H. Woolwine & John Harwood, 901 American Trust Bldg.

Texas

Abilene

David S. Castle Co., 108½ N. First St., Box 124
C. R. Gaskill, Jr., 512 Alexander Bldg.
Hughes & Olds, Box 1331

Amarillo

Macon O. Carder, 317 Fisk Bldg.
Guy A. Carlander, Box 3158
R. S. Lantz, General Delivery
Emmett F. & James F. Rittenberry, 1000 Fisk Bldg.
Townes & Funk, 1208 W. 10th Ave.

Austin
- Giesecke-Kuehne & Brooks, 904 Littlefield Bldg.
- C. H. Page & Son, 207 W. 7th St.
- Page, Southerland & Page, Nalle Bldg. Annex
- John L. Scott, 918 Littlefield Bldg.
- Roy L. Thomas, 2812 N. Guadalupe St.

Beaumont
- A. Babin, Box 2346
- Wallace B. Livesay, Box 2228
- Stone & Pitts, 1200 Goodhue Bldg.
- N. E. Wiedemann, 614 American Nat'l Bank Bldg.

Cameron
- J. E. Johnson

College Station
- P. G. Norton, Agricultural & Mechanical College

Corpus Christi
- Brock, Roberts & Anderson, 210 Jones Bldg.
- Hamon & Co., 715 S. Tancahua St.
- Nat W. Hardy, 59 Country Club Place
- Ralph E. Scamell, 325 Cole St.
- R. L. Vogler, 225 Oleander St.

Corsicana
- Blanding & Horn, Mays Bldg.

Dallas
- Arthur A. Brown, 221 N. Edgefield
- *Ralph Bryan, Construction Bldg.
- Eugene Davis, 3736 Purdue St.
- Flint & Broad, Burt Bldg.
- La Roche & Dahl, 1102 Southland Life Annex
- Mark Lemmon, 213 Tower Petroleum Bldg.
- J. N. McCannon, 210½ So. St. Paul St.
- Maurice Peterman, 4303 Trellis Court
- Arthur E. Thomas, 307 Construction Bldg.

El Paso
- F. W. Carroll, 2520 San Jose St.
- Frazer & Benner, El Paso Nat'l Bank Bldg.
- Trost & Trost, El Paso Nat'l Bank Bldg.

Fort Worth
- Adam A. Bliss, 621 Colvin
- C. O. Chromaster, Century Bldg.
- W. G. Clarkson & Co., First Nat'l Bank Bldg.
- Preston M. Geren, 806½ Burnett St.
- Wyatt C. Hedrick, 1005 First Nat'l Bank Bldg.
- C. M. Love & Co., 314 S. Henderson St.
- W. C. Meador, 806 S. Henderson St.
- Albert S. Ross, 3135 Trouis

Galveston
- R. R. Rapp, 417 Guaranty Bldg.

Georgetown
- L. L. Huie

Grand Prairie
- C. H. Leinbach & Bro., Rt. 1—Box.

Henderson
- J. L. Downing, 406 N. High St.

Houston
- *Lamar Q. Cato
- G. J. Cannon, 2710 Louisiana St.
- Cameron Fairchild, 3044 San Felipe Rd.
- Alfred C. Finn, Bankers Mortgage Bldg.
- Hedrick & Lindsley, Inc., 818 Southern Standard Bldg.
- Henry F. Jones & Tabor, 209 Union Nat'l Bank Bldg.
- Wilbur Kent, 1710 Bolsorer Rd.
- Jos. W. Northrop, Jr., 4009 Center St.
- Harry D. Payne, 3455 Ella Lee Lane
- R. G. Schneider & Co., Inc., 520 W. Bell
- Ernest L. Shult, 5009 Fannin St.
- Henry Aam Stubee, 4310 Fernwood
- Maurice J. Sullivan, 3901 Travis St.
- Wirtz, Calhoun & Willauer, 500 Stuart Ave.

Longview
- N. L. Peters, Box 1866

Lubbock
- The Butler-Huseman Co., 406 Ave. M
- Haynes & Strange, 415 Myrick Bldg.
- O. R. Walker, Box 948

Nacogdoches
- Hal B. Tucker, Carson Bldg.

Palestine
- O. L. Hazelwood, Link Bldg.

Paris
- Will H. Lightfoot, Lamar & 21st St.
- Edwin R Smith, N. Main St.

Port Arthur
- J. E. Neff, Box 1105

San Angelo
- D. C. Maddux, 1004 S. Oakes St.
- Mauldin & Lovett, 521 W. Beauregard St.

San Antonio
- Leo M. J. Dielmann, 145 North St.
- Jno. M. Marriott, 220 Frost Bank Bldg.
- Will N. Noonan, Builders Exchange Bldg.
- Phelps & Dewees & Simons, 1515 Majestic Bldg.
- Paul G. Silber & Co., 1919 Cincinnati Ave.
- Harvey P. Smith, 312 Nat'l Bank of Commerce Bldg.
- Chas. T. Weidner, Frost Bank Bldg.
- George Willis, Builders Exchange Bldg.

Sweetwater
- Don W. Smith, 701 E. Arkansas St.

Tyler
- Gregory & Cates, Gary Bldg.

Waco
- Walter Cocke, Jr., & Co., 1503 Franklin Bldg.

Wichita Falls
- *Voelcker & Dixon, Inc., Box 1799

Utah

Logan
- Karl C. Schaub and Son

Ogden
- Leslie S. Hodgson, Eccles Bldg.

Provo
- Claude Shepherd Ashworth, 44 W. 2nd St., N.
- Jos. Nelson, 135 E. Center St.

Salt Lake City
- Ashton & Evans, 312 Beneficial Life Bldg.
- Cannon & Muller, 506 Templeton Bldg.
- Fetzer & Fetzer, 415 Templeton Bldg.
- Niels P. Larsen, 68 S. Main St.
- Miles E. Miller, 312 Felt Bldg.
- Carl W. Scott, 617 Dooly Bldg.
- *Lorenzo S. Young, 826 Continental Bank Bldg.

Vermont

Burlington
- Freeman-French-Freeman, 138 Church St.

Virginia

Charlottesville
- S. J. Makielski, Barracks Road

Newport News
- Williams, Coile & Pipino, 408 Melson Bldg.

Norfolk
- Vernon A. Moore, Flat Iron Bldg.
- C. A. Neff, 600 Western Union Bldg.
- Rudolph, Cooke & Van Leeuwen, Inc., 355 Monticello Arcade Bldg.

Richmond
- Baskerville & Son, 2202 Central Nat'l Bank Bldg.
- Carneal, Johnston & Wright, 1000 Atlantic Life Bldg.
- W. Irving Dixon, Dr. of School Bldgs., State Dept. of Ed., State Off. Bldg.
- J. Binford Walford, 103 E. Cary St.
- Marcellus Wright & Son, 1103 E. Main St.

Roanoke
- Eubank & Caldwell, Inc., 510 Boxley Bldg.
- *Smithey & Boynton, 818 Wycliffe
- John M. Thompson, 411 George Ave., S. W.

Washington

Aberdeen
- C. W. George, 203 Becker Bldg.

Bellingham
- F. Stanley Piper, 200 Herald Bldg.

Bremerton
- B. H. Branch, 2616 E. 11 St.

Longview
- The Office of Ray V. Weatherby, Henry Bldg.

Pullman
- Stanley A. Smith, State College of Washington

Seattle
- Chas. H. Bebb & John Paul Jones, 715 Hoge Bldg.
- John Graham, 1501 Dexter Horton Bldg.
- J. T. Jacobsen, 719 2nd Ave. Bldg.
- Wm. Mallis, 330 Lyon Bldg.
- Earl W. Morrison, 719 2nd Ave.
- Naramore & Brady, 1177 Dexter-Horton Bldg.
- Fred B. Stephen, 2108 Smith Tower
- Geo. Wellington Stoddard & Associates, Orpheum Bldg.
- Roland R. Wilcken, 4436 Renton Ave.

Spokane
- Henry C. Bertelsen, 610 Empire State Bldg.
- G. A. Pehrson, 1312 Old National Bank Bldg.
- Edwin J. Peterson, Sherwood Bldg.
- Geo. M. Rasque & Son, Washington Trust Bank Bldg.
- Rigg & Vantyne, 525 Peyton Bldg.
- Whitehouse & Price, Hutton Bldg.

Tacoma
- E. J. Bresemann, Perkins Bldg.
- Lea, Pearson & Richards, Tacoma Bldg.
- Mock & Morrison, 228 Perkins Bldg.
- Chas. and Clarence Rueger, 1617 Puget Sound Bank Bldg.
- Sutton, Whitney & Dugan, 825 W. R. Rust Bldg.

Vancouver
- D. W. Hilborn, 307 East 10 St.
- Donald J. Steward, 222 Central Bldg.

Wenatchee
- L. Solberg, 5 Widby Bldg.

Yakima
- John W. Maloney, 1117 Larson Bldg.
- Walter H. Rothe, 333 Liberty Bldg.

West Virginia

Bluefield
- Robert A. Sheffey, 614 Appalachian Bldg.
- Alex. B. Mahood, 701 Law Commerce Bldg.

Charleston

Herbert S. Kyle, Suite 1107 Union Trust Bldg.
Walter F. Martens, Route 1, Box 334, Fort Hill
Tucker & Silling, 314 Masonic Temple Bldg.

Fairmont

L. D. Schmidt, Professional Bldg.

Huntington

Frampton & Bowers, 412 11th St.

Wellsburg

Ralph W. Whitehead, Banking & Trust Bldg.

Wheeling

Frederick Faris, 1117 Chapline St.
Kenneth G. Paxton, Board of Trade Bldg.

Wisconsin

Appleton

Robert Connelly, Box 84
LeVee & Allen, 203 E. College Ave.

Boscobel

Jos. G. Durrant, 400 E. Bluff St.

Eau Claire

Klinger & Hubbard, Culver Bldg.
Howard M. Nelson, 416 S. A. F. Bldg.

Green Bay

Gordon Feldhausen & Gardner C. Coughlen, 414 E. Walnut St.
Foeller, Schober, Berners, Safford & Jahn, 310 Pine St.
Levi A. Geniesse, 226 N. Washington St.
Oppenhamer & Obel, 110 S. Washington St. (also in Wausau)

* In Service

La Crosse

Boyum, Schubert & Sorenson, 527 Hoeschler Bldg. (also in Winona, Minn.)
J. Mandor Matson, 324 Exchange Bldg.
Parkinson & Dockendorff, 404 Linker Bldg.

Madison

John J. Flad & Thos. H. Flad, Associates, 133 Langdon St.
Law, Law & Potter, 1 So. Pinckney St.
Lewis Siberz, 103 W. Mifflin St.
Starck & Schneider, Inc., 8 S. Carroll St.
Edw. Tough, 119 E. Washington Ave.

Manitowoc

Percy Brandt, Dempsey Bldg.
Wm. J. & F. W. Raeuber, 926 S. 8 St.

Marinette

Max Hanisch, 108 Stephenson Block
Donald M. Schoepke, Strand Theatre Bldg.

Marshfield

Gus A. Krasin, 208 S. Central Ave.

Milwaukee

E. Brielmaier & Sons Co., 735 N. Water St.
Brust & Brust, 135 W. Wells St.
Clas & Clas, Inc., 759 N. Milwaukee St.
Gerrit J. deGelleke, 152 W. Wisconsin Ave.
Ebling & Plunkett, 739 N. Broadway
Eschweiler and Eschweiler, 720 E. Mason St.
Leon M. Gurda, 3020 So. Logan Ave.
Lindl, Schuette & Lefebvre, 6101 N. Lydell Ave.
W. G. Memmler, 1325 E. Hartford Ave.
Robert A. Messmer & Bro., 231 W. Wisconsin Ave.
Wm. H. Mitterhausen, 2137 N. 55 St.
Fitzhugh Scott, 724 E. Mason St.
Alfred H. Siewert, 2309 N. 36th St.
Roger A. Sutherland, 259 E. Wells St.
John Topzant, 424 E. Wells St.
Herbert W. Tullgren, 1234 N. Prospect Ave.
Guy E. Wiley, 2213 N. 34 St.

Monroe

Stanley W. Howe, 1518 11th St.

Oshkosh

Auler, Jensen & Brown, E. R. A. Bldg.

Racine

B. Wade Denham, 1520 Washington Ave.
F. J. Hoffman, Janes Bldg.

Sheboygan

Edgar A. Stubenrauch, 708 Erie Ave.

Superior

Roland C. Buck, Inc., 201 Telegram Bldg.

Two Rivers

Sylvester Schmitt, Bank of T. R. Bldg.

Wausau

Oppenhamer & Obel, 610½ Third St. (Also in Green Bay)

Wauwautosa

Mark F. Pfaller, 8525 Ravenswood Circle

Wisconsin Rapids

A. F. Billmeyer & Son, 172 2nd St., South

Wyoming

Casper

Leon C. Goodrich, 504 So. McKinley St.
Karl L. Krusmark, 104 N. Wilson St

Cheyenne

Frederic H. Porter, 423 E. 16 St.

SECTION IV
LANDSCAPING

BETTER LAWNS FOR SCHOOLS AND COLLEGES

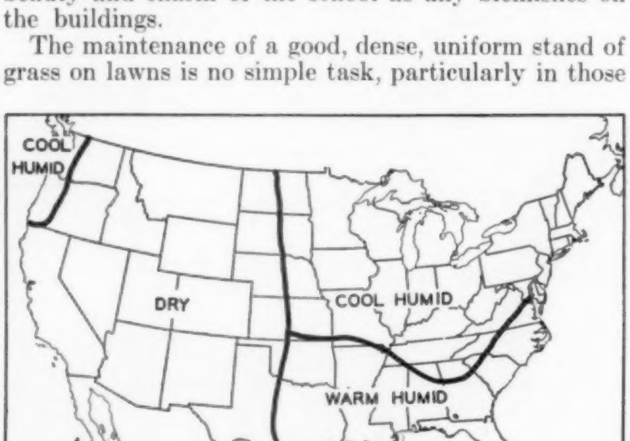
By FANNY-FERN DAVIS

Acting Director, United States Golf Association Green Section

GREEN grass is as indispensable as a setting for public buildings as for homes. Long ago the planners of colleges and universities recognized this fact, as shown by names such as the "Lawn" of the University of Virginia and the Harvard "Yard," which, through the years, have designated those parts of the campuses around which the original buildings were placed.

Yet in spite of the fundamental importance of the lawn in enhancing the architectural beauty of the school or college, in eliminating mud and dust, or in providing a good playing surface on recreation fields, the grass usually receives surprisingly little attention. The turf on campuses today is too frequently taken for granted by administrators, faculty, and students alike until it becomes conspicuous by its absence. Invariably there occur the footpaths marking what students have demonstrated as the shortest distance between two points, the large bare or mossy areas under trees, and the trampled and bare areas immediately adjoining walks and buildings. Similar blemishes and scars to the buildings themselves would not be tolerated. Yet such eyesores on the grounds are tolerated in spite of the fact that they play just as much if not more havoc with the over-all effect of the beauty and charm of the school as any blemishes on the buildings.

The maintenance of a good, dense, uniform stand of grass on lawns is no simple task, particularly in those sections of the country where the climate and soil conditions are not favorable to our more common turf grasses. Where renovation is necessary and grass is to be established on bare areas, the first question which must be answered is what grass or grasses to use and how to plant them under the existing conditions. Since the most common method of planting is to sow seed, something should be understood concerning the characteristics to be looked for in buying seed, as well as the recommended rates and time of seeding. Once reasonably good turf is present, the chief questions to be considered in a maintenance program are fertilizer and lime requirements; control of disease, weeds, and insect pests; mowing practices; and watering.



Map depicting three general climatic regions of the United States. The grasses to be used in each region are determined by the climatic factors of that region

Types of Grasses for Turf

To be successful as turf, a grass must not only tolerate constant defoliation but prosper under it during the growing season; its leaves should be erect, of a good color, and fine in texture; it must spread laterally and make a dense, tough, wear-resistant ground cover; and it should be resistant to disease, particularly when the turf is well fertilized and watered; because the lush growth which results under these conditions is likely to be susceptible to the fungi which cause most of the grass diseases. Also, all other factors being equal, the lower growing species and strains are more desirable than the tall upright ones because they require less mowing. It is not surprising, therefore, that although there are some 1,100 species of grasses in the United States, not more than 30 of them will produce satisfactory turf. It is interesting to note in this connection that many of our most common turf grasses are not native species. Kentucky bluegrass, for instance, was imported originally from Europe.

As the climatic conditions in the United States have an extremely wide range, it is reasonable to suppose that grasses which produce excellent turf in one section of the country may not be able even to survive in other sections. For the purpose of a discussion of even the most common turf grasses, therefore, it is necessary to divide the country into three general climatic regions, as indicated in the accompanying map, and to discuss the grasses under each region. In Table 1 information has been summarized concern-

ing the conditions under which the grasses may be expected to produce successful turf, the time and method of planting, and the characteristics to be expected of high-quality seed.

Cool Humid Region.—For general lawn purposes in the Cool Humid Region, particularly in open areas, Kentucky bluegrass can usually be depended upon to produce a satisfactory turf provided there is adequate rainfall. Kentucky bluegrass seed sown in late summer, either alone or in a mixture of which it comprises from 85 to 90%, with from 1 to 5% of Colonial bent and the remainder redtop, may be expected to produce excellent turf. The redtop in such a mixture should be considered as a nurse grass. It germinates quickly and protects the bluegrass seedlings, which come on somewhat later; but it is not likely to persist more than 2 or 3 years in a mixed stand. When used on fertile soils it is likely to become coarse and therefore a less desirable component of the turf after the first year. Redtop will tolerate poor soils, however, and

TABLE 1

GRASSES FOR TURF FOR THE THREE GENERAL CLIMATIC REGIONS OF THE UNITED STATES

Common Name	Scientific Name	Planting		Characteristics To Be Expected in High Quality Seed				Comments
		Method	Best Season	Minimum Percentage of Purity[1]	Minimum Percentage of Germination[1]	Maximum Percentage of Weed Seed	Approximate Number of Pure Seed in 1 Lb.	
Cool Humid Region:								
Kentucky bluegrass	*Poa pratensis* L.	Seed	Early Fall	95	85	0.2	2,250,000	Most widely used grass for this area.
Trivialis bluegrass	*Poa trivialis* L.	Seed	Early Fall	98	88	.3	2,500,000	Best grass for cool, moist, shaded areas.
Redtop	*Agrostis alba* L.	Seed	Early Fall	95	90	.2	5,000,000	Tolerates poor soil, becomes coarse after first year on fertile soil. Used as nurse grass for more slowly germinating bluegrass. Should not constitute more than 10 to 15% by weight of mixture.
Chewings fescue	*Festuca rubra* L. var. *commutata* Gaud.	Seed	Early Fall	97	85	.2	600,000	Excellent grass for shady well-drained areas. Also used in northern states of this region on sandy soils in sun or shade.
Creeping red fescue	*Festuca rubra* L.	Seed	Early Fall	95	85	.2	600,000	Same value as Chewings fescue.
Italian ryegrass	*Lolium multiflorum* Lam.	Seed	Fall or Spring	99	95	.1	225,000	Useful as temporary or nurse crop. Should not constitute more than 10% by weight of permanent grass seed mixture.
Perennial ryegrass	*Lolium perenne* L.	Seed	Fall or Spring	99	90	.1	300,000	Used similarly to Italian ryegrass but is less desirable in permanent seed mixtures because of its persistence.
Colonial bent	*Agrostis tenuis* Sibth.	Seed	Fall	95	90	.2	8,000,000	One of the dominant lawn grasses in New England and the Northwest. Also used in bluegrass and fescue mixtures, to the extent of 5 to 10%.
Creeping bent	*Agrostis palustris* Huds.	Seed Sprigs	Fall Spring	95	90	.2	6,000,000	Known chiefly for use on golf course greens. However, in certain northern sections it is used successfully in lawn seed mixtures.
Velvet bent	*Agrostis canina* L.	Seed Sprigs	Fall Spring	94	85	.4	10,000,000	Excellent grass for golf course greens and lawns in New England.
White Dutch clover	*Trifolium repens* L.	Seed	Fall	97	85	.5	800,000	Used in small percentages in seed mixtures when not objectionable in turf because of its ability to supply nitrogen and also to give a green color when the permanent grasses are dormant.
Warm Humid Region:								
Bermuda grass	*Cynodon dactylon* (L.) Pers.	Seed Sprigs	Spring Spring	95	85	.2	1,750,000	Most widely used summer grass for this area.
Centipede grass[2]	*Eremochloa ophiuroides* (Munro) Hack.	Sprigs	Spring					Thrives on light, dry, sandy soils of low fertility. Also considered a good grass for shade in the South.
Narrow-leaved carpet grass	*Axonopus affinis* Chase	Seed	Spring	90	90	.1	1,125,000	Requires more moisture than Bermuda grass, and thrives best on clay soils. Better adapted to low wet soils than any southern grasses.
Broad-leaved carpet grass	*Axonopus compressus* (Schwartz) Beauv.	Seed	Spring	90	90	.1	1,125,000	Used on lawns and golf courses on clay soils, same as above.
Manila zoysia[2]	*Zoysia matrella* (L.) Merr.	Sprigs	Spring					Forms dense, tough sod, low-growing, but slow to become established. Finer leaves than Japanese zoysia. Survives winter climate as far north as Boston.
Japanese zoysia[2]	*Zoysia japonica* Steud.	Sprigs	Spring					Forms dense, tough sod, coarser leaved than Manila zoysia. Slow to become established.
Bahia grass	*Paspalum notatum* Flügge	Seed Sprigs	Spring Spring	75	80	.5	160,000	Forms dense, durable turf, but is not cold resistant. Should be used only in extreme South.
St. Augustine grass[2]	*Stenotaphrum secundatum* (Walt.) Kuntze	Sprigs	Spring					Does well in extreme South provided adequate moisture is available. Tolerates shade and sun, as well as a wide range of soil conditions.
Italian ryegrass	*Lolium multiflorum* Lam.	Seed	Fall	99	95	.1	225,000	Used only as a winter cover or as a temporary grass where quick effects are necessary.
Perennial ryegrass	*Lolium perenne* L.	Seed	Fall	99	90	.1	300,000	Used similarly to Italian ryegrass.
Dry Region:								
Buffalo grass[3]	*Buchloë dactyloides* (Nutt.) Engelm.	Sprigs Seed	Spring Spring	?	?	?	?	Drought resistant, low growing, rapidly spreading grass which forms a tough sod. Therefore the most generally useful turf grass in the Dry Region. Seed treatment necessary to improve germination.
Kikuyu grass[2]	*Pennisetum clandestinum* Chiou.	Sprigs	Spring					Is apparently successful along coastal regions of California. Drought resistant.
Bermuda grass	*Cynodon dactylon* (L.) Pers.	Seed Sprigs	Spring Spring	95	85	.2	1,750,000	Does fairly well in southern states of this region, where it can be watered.
Kentucky bluegrass	*Poa pratensis* L.	Seed	Fall	95	85	.2	2,250,000	Thrives in northern states of this region, where it can be watered.
Crested wheatgrass (Fairway strain)	*Agropyron cristatum* (L.) Beauv.	Seed	Early Spring	98	90	.3	325,000	Winter hardy and drought resistant. Limited to northern latitudes and high altitudes. Fairway strain does not form tufts and is finer leaved than the regular crested wheatgrass.

[1] These characteristics differ somewhat from year to year, depending on climatic conditions at the time of maturation and harvest.
[2] Not reproduced commercially by seed, and therefore characteristics of the seed are not significant.
[3] Some seed is available but no information has been obtained regarding what characteristics can be expected in high quality seed. The number of seeds per pound is variable since the seeds are covered with hulls which differ in size considerably with different lots of seed.

can therefore be used in some cases where bluegrass would not survive.

For shaded areas which are well drained, particularly where there is sandy loam soil, it would be wise to replace as much as 40 to 60% of the Kentucky bluegrass seed in the above mixture with Chewings fescue or creeping red fescue. As seed of these fescues is usually considerably more expensive than is that of Kentucky bluegrass, fescues should not be used unless the soil and drainage are satisfactory. They will not do so well on poorly drained heavy clay soils. The value of the fescues lies in the fact that they tolerate shade and lack of moisture better than does Kentucky bluegrass; and may therefore produce a satisfactory turf under trees when other grasses will not survive.

On shaded areas which remain wet, trivialis bluegrass will grow much better than the fescues. As the sources of our commercial supply of this seed are the Scandinavian countries, however, the seed is not now available. When it can be obtained, from 20 to 30% of the Kentucky bluegrass seed in the mixture can be replaced by it if the mixture is to be used on wet shaded areas.

On areas where a quick effect is necessary or where a temporary turf seems advisable, ryegrass may be substituted for the Kentucky bluegrass to the extent of from 20 to 40%. Italian ryegrass is an annual and grows for only one year. Perennial ryegrass may persist in turf for as much as 3 or 4 years in the North; but in the South rarely more than a few scattered plants survive after the first or second year. Mixtures which contain large amounts of ryegrass, therefore, should not be considered for other than temporary purposes. Seedsmen frequently include rather large amounts of ryegrass in their commercial mixtures on the basis that it should be used as a nurse crop to protect the more slowly germinating Kentucky bluegrass. When used for that purpose it should not comprise more than 10% of the mixture.

In parts of New England and the Northwest, the bent grasses are the most common lawn grasses and where they are successful they are to be preferred.

Warm Humid Region.—In the Warm Humid Region there is not so wide a choice of grasses that will make a satisfactory turf. Bermuda grass is at present no doubt more widely used than any of the others. It thrives under high temperatures and grows rapidly during the summer. Also it thrives on a wide range of soils and will tolerate considerable abuse. It may be planted either by seed or by stolons, which are the creeping stems, each node of which will produce roots when lightly covered with soil. When 1 square foot of sod is broken up and the stolens chopped into pieces, there should be enough plant material to plant 20 sq. ft. If the sod which is used for planting purposes is thin or weedy, however, there may not be more than enough stolons from 1 sq. ft. to plant 10 sq. ft. This method of planting is referred to as sprigging.

Bermuda grass should be planted in the spring, as it is a summer growing grass and is dormant in the winter. It must be planted sufficiently early in the season to permit a good stand of grass to develop before cool weather sets in. If the turf is to be established from seed, hulled seed should be used, because it germinates much faster than the unhulled seed.

Other grasses which may be used in the South are centipede grass, the carpet grasses, St. Augustine grass, several species of Zoysia, and possibly Bahia grass. Most of these, except the carpet grasses and Bahia grass, are usually established by sprigging. Centipede grass does well on light, dry, sandy soils along the coast of Florida and the Gulf States. The carpet grasses prefer the heavier clay soil and require more moisture than Bermuda grass. Like redtop in the Cool Humid Region, however, they are better used in a mixture than alone.

The Zoysias, although subtropical grasses, will survive moderate winters as far north as Boston. The low-growing, dense, wear-resistant turf which they form may prove of real value on recreational grounds. The use of the Zoysias for turf is still in the experimental stage, but stolons are now available commercially. The chief objection to their use seems to be that new plantings are slow to become established. Once the turf is established, however, the Zoysias apparently are able to compete unusually well with weeds.

In the extreme South, Bahia grass and St. Augustine grass are most useful. Both are well adapted to a wide range of soils but are sensitive to low temperatures. In addition, St. Augustine grass will not be satisfactory unless adequate moisture is available.

Dry Region.—In the Dry Region of the West, buffalo grass, which is a drought-resistant, low-growing grass, is perhaps most generally useful except in the northern latitudes and at high altitudes where the Fairway strain of crested wheatgrass is the most satisfactory drought-resistant turf grass. Kikuyu grass has given indications of being drought-resistant in tests made in Australia, and some plantings along the coastal areas of California have indicated that it may be successfully used for turf in this country. Where it is possible to use water in the Dry Region, Bermuda grass can be successfully grown in the southern, and Kentucky bluegrass in the northern sections.

Methods of Planting

There are various means of establishing turf, depending among other things on the nature of the area to be turfed, the kind of grass to be used, and the time of year when the area must be planted.

Sodding.—On hard-packed areas, such as the cross-cuts that are so frequently made from one building to another on every campus, or on bare areas adjoining walks or building entrances, as well as on steep slopes, sodding is likely to be the most successful method to use. In anticipation of using sod for such purposes it would be well, when ground is available on an inconspicuous part of the campus, to have a sod nursery composed of the same type of grass as the lawn and maintained with the same practices. Sod could be lifted from this nursery and put directly in place on areas that are subject to too much wear and tear to permit young seedling grass to develop.

Sod cut 1 in. thick has many surface roots exposed and therefore becomes anchored more quickly than does thick sod, provided watering facilities are available in case of insufficient rainfall. Sod cut 2 in. or more thick will not be so likely to dry out; but it will not become established so quickly in its new position as the thinner sod.

Sprigging.—Another method of planting which, like

sodding, makes use of vegetative material rather than seed, is the method referred to earlier as sprigging. By this method small fragments or sprigs of vegetative material with little or no soil attached are either broadcast or planted in rows and covered lightly with soil. This method can be used with grasses which produce runners on the surface (stolons), or under the ground (rhizomes), because each node of these runners is able to produce roots when covered with soil and provided with sufficient moisture. It is vitally important, however, that the sprigs be covered immediately after planting and that the moisture and climatic conditions are such as to encourage the rapid growth of the newly rooted plants. With this method, therefore, the question of the time of year of planting should receive primary consideration.

Seeding.—The cheapest and most generally used method, of course, is to sow seed. When seeding a new area, the surface soil should be finely pulverized and the fertilizer and lime worked in to a depth of 2 to 4 in. before the seed is sown. If bare spots in established turf are to be seeded the hard-packed areas should first be loosened with a fork, in order that the seeds can become firmly lodged and will not wash off the hard surface into the existing turf.

Throughout most of the Cool Humid Region, late summer or early fall is the ideal time for seeding lawns. The warm sunny days, accompanied by cool nights and sufficient rainfall, furnish ideal conditions for germination of the seeds. Moreover, in the fall many of the troublesome turf weeds die or become dormant, so that the turf grasses can grow with the minimum competition from weeds and establish a turf which will be sufficiently dense the following spring to fight a winning battle with invading weeds. Also the fall-sown grasses usually send their roots deeper into the soil than do the spring sown grasses, which more commonly produce a lush growth with roots close to the surface where they are likely to be readily injured by summer heat and drought.

A common error in seeding new areas with grass is to use too much seed and too little fertilizer. It has been shown by tests made in collaboration with A. E. Rabbitt, of the National Capital Parks, that the best combination on poor, infertile soil was 40 lbs. of 10-6-4 inorganic fertilizer and from 2 to 3 lbs. of Kentucky bluegrass seed to 1,000 sq. ft. Seedings made at this rate in late summer or very early fall produced the best turf. Heavier rates of seeding produced a denser turf in the fall; but late the following spring disease attacked the dense, lush growth and killed the bluegrass, thereby making room for crabgrass to come in. The result was that a year after planting on the plots seeded at heavier rates the turf was decidedly poorer and more weed infested than that on plots seeded at rates even as low as 1 lb. of seed to 1,000 sq. ft. To get a good stand a few months after seeding, however, the 2- to 3-lb. rates were better.

All seedmen are able to provide their customers with information concerning the characteristics of their seed. In buying Kentucky bluegrass seed, for instance, one should know the weight per bushel of seed, the maximum weed seed content, as well as the purity and germination. Table 1 includes information concerning the minimum percentage of germination and purity which should be expected of high quality seed, and the maximum percentage of weed seed of most of the common turf grasses for which seed is available. Generally speaking, if the other characteristics are equally good the heavier seed is more desirable than the light-weight seed. The fact that the seed is heavier simply means that the seeds themselves are more plump and will probably produce more vigorously growing grass plants. Usually it is more economical in the long run to buy the heavier seed, although the price may be a few cents higher.

Turf Grass Seed Mixtures

As will be noted in Table 1, the number of seeds per pound varies over a wide range for the different grasses. When a seed mixture is made up principally of Kentucky bluegrass a seeding rate of from 2 to 4 lbs. to 1,000 sq. ft. should be adequate. Reference to this table will show that the ryegrass and fescue seeds are much larger; therefore, as the percentage of ryegrass or fescue in the mixture increases, the seeding rate should be increased to some extent. It will be likewise noted that the bent and redtop seeds are much smaller. Accordingly the seed rate for these latter grasses should be less than that for Kentucky bluegrass.

Where any considerable amount of a mixture of seeds is to be used, it would be more economical and more satisfactory to buy the pure seed of each grass to be used and mix them or have the dealer mix them in the desired proportions. Commercial mixtures—both good and bad—are available, but even the most expensive of these mixtures frequently contain astonishingly large proportions of redtop, the ryegrasses, and even timothy, the only purpose of which is to act as nurse grasses to the more slowly germinating permanent grasses or to give a quick, temporary effect. This does not justify using more than a total of 10% or at the very most 20% of these grasses. It should be remembered, moreover, that the price of these seeds is much less than that of Kentucky bluegrass, the fescues, bents, or other permanent turf grasses. It is not wise, therefore, either from the standpoint of getting good turf or of economy, to buy commercial seed mixtures unless they contain relatively large proportions of seed of the permanent grasses and small proportions of the nurse grasses. By law the consumer is protected by labels which must appear on each package, giving the percentage by weight of each grass seed included, together with its percentage germination and purity. These labels should be studied before purchasing commercial seed mixtures.

As far as weed seed content is concerned, it is frequently more helpful to know the kind rather than the number of weed seed which are present, for the reason that though many weeds will grow in grass permitted to grow high and seed, they will not survive the close cutting which they get in turf. On the other hand, a weed seed content of even 0.1% may be serious if the seeds are those of turf weeds. A contamination of 0.1% by weight of chickweed, for instance, will introduce at least 100 seeds to every square foot when grass seed is sown at the rate of 3 to 4 lbs. to 1,000 sq. ft.

Fertilizer and Lime Requirements of Turf

One of the most common causes of thin, weedy, or moss-covered turf is starvation of the perennial turf

grasses which are present. In renovating such areas little is to be gained by sowing seed if the plants which are already present are unable to grow because of lack of food. On such areas remarkable results can frequently be achieved, on the other hand, by the application of adequate amounts of the right kind of fertilizer.

Fertilizer, properly applied, stimulates the growth of both the leaves and the roots of the plants present. The grass roots and clippings thus produced in turn serve to add organic matter to the soil and thereby improve its physical structure. When the soil is composed of heavy clay and is insufficiently drained, however, it may be necessary to dig up the area and lay agricultural tile; or perhaps the soil may be loosened by disking lime or sand, or both, into the surface to a depth of 4 to 6 in. When lime is used, an application at the rate of 1 ton to the acre is usually sufficient. Soil-acidity determinations are quickly made and will indicate whether or not lime is necessary and if so, how much should be added.

The three mineral elements which are most essential for plant growth are nitrogen, phosphorus, and potassium. Nitrogen is the element which is primarily needed for luxuriant leaf growth; and as it is rapidly leached from the soil it is usually the element to which grass responds most readily. Phosphorus, on the other hand, stimulates root growth as well as flower and seed production and general maturation processes. The function of potassium is less specific, its principal role being to influence the growth processes in general. Phosphorus and potassium are less likely to be leached from the soil. They are usually required in smaller quantities by the grass, and are, moreover, returned to the soil through the clippings, when they are permitted to fall on the turf. Although the relative amounts of the three elements which are necessary for turf differ somewhat with the soil and the type of grass to be grown, generally the most favorable proportions of these elements for turf are half as much phosphoric acid as nitrogen, and still less potash.

The composition or grade of a mixed fertilizer is expressed in three numbers: the first indicating the amount of nitrogen (N), the second the amount of phosphoric acid (P_2O_5), and the third the amount of potassium in the form of potash (K_2O). For example, a 12-6-4 commercial fertilizer contains a minimum of 12% of nitrogen, 6% of phosphoric acid, and 4% of

Photograph taken in February showing the results of one application of fertilizer to a crabgrass and weed-infected bluegrass turf the preceding October. The light areas indicate unfertilized turf. The wide dark strip in the center was fertilized with sufficient amounts of 6-12-4 mixtures to furnish 2 lbs. of nitrogen to 1,000 sq. ft. The left-hand side of the strip had received an organic and the right-hand side an inorganic mixture. In the extreme left background is a still more vigorously growing plot which had received a 6-12-4 inorganic mixture at the rate of 4 lbs. of nitrogen to 1,000 sq. ft.

TABLE 2

ORGANIC SOURCES OF NITROGEN FOR USE AS FERTILIZERS

Organic Material	Approximate Average Analysis			Chief Production Area
	Nitrogen (N) %	Phosphoric Acid (P_2O_5) %	Potash (K_2O) %	
Cottonseed Meal	6.5	2.3	1.8	South
Soybean Meal	7.0	1.5	2.5	Midwest
Linseed Meal	6.0	1.8	1.5	Northwest
Peanut Meal	7.0	1.5	1.2	South
Milorganite	6.0	2.5	...*	Midwest
Chicagrow	5.0	3.0	...	Midwest
Hu-Actinite	5.0	2.8	...	South Central
Nitroganic	6.0	2.5	...	California
Raw Bone	4.0	22.0	...	Midwest
Steamed Bone	2.5	27.0	...	Midwest
Dried Blood	12.0	2.0	...	Midwest
Animal Tankage	8.0	10.0	...	Midwest
Process Tankage	9.0	...	...	East
Fish Scrap	9.0	7.0	...	All Coasts
Dried Poultry Manure	5.0	2.5	1.3	Atlantic Coast
Dried Sheep Manure	2.0	1.5	3.0	Atlantic Coast
Dried Cattle Manure	2.0	1.5	2.5	Atlantic Coast
Castor Pomace	5.5	2.5	1.0	East
Cocoa Shells	2.5	1.5	2.5	East

* Less than 1% is not considered appreciable and is indicated by ....

potash. When inorganic fertilizers are used on turf, a high nitrogen mixture, such as a 12-6-4, a 10-6-4, or a similar grade is likely to give most satisfactory results.

For the duration of the war, however, no chemical nitrogen can be used on turf. By chemical nitrogen we refer to the nitrogen of all nitrogenous salts whether they be inorganic or organic. This restriction is, of course, due to the fact that the nitrogen requirements for the defense of the United States have created a great demand for chemical nitrogen. What chemical nitrogen is still available for fertilizer must be used on food crops. There are no restrictions on superphosphate, muriate of potash, or any other fertilizer materials.

Since nitrogen is so vitally important for a good vigorous growth of turf, recourse will have to be taken to natural organic products. In many areas sewage sludge or by-products of local industries are available. Where such materials are available their use should definitely be considered. Small test plots of approximately 100 sq. ft. will serve to give an indication of what can be expected from their use. Such test plots should be accompanied by other plots that have been fertilized with materials the results of which are recognized as being satisfactory under your conditions. The value of testing such locally available natural sources of nitrogen can not be overemphasized.

Some of the possible organic sources of nitrogen are given in Table 2, together with the approximate average analysis, and the area in which they are principally produced. It should be remembered that these natural products vary in their mineral composition over a wide range. For instance, different samples of dried blood may vary in nitrogen content from a minimum analysis of 6% to a maximum analysis of 14%. The bone meals vary from 0.7% of nitrogen to 5.3%; and from 17.0% to 30.0% of phosphoric acid. However, the figures in Table 2 will serve to give an idea of what can be expected on an average in the way of plant foods from these materials.

Relative Values of Organic and Inorganic Nitrogen Materials.—Some of the organic nitrogen sources have been compared with inorganic fertilizers in experimental plots conducted by the staff of the United States Golf Association Green Section for from 10 to 15 years. The differences between the use of inorganic and organic materials may be summed up as follows:

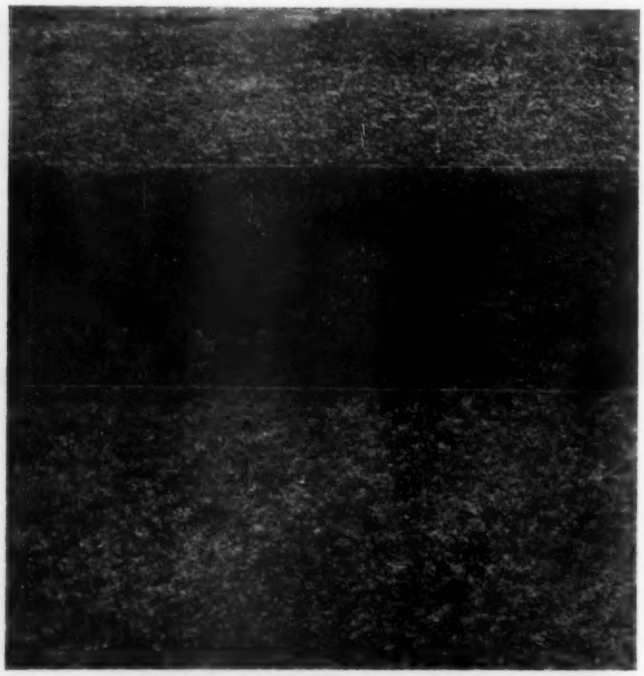
When applied to established turf, the danger of burning the grass is considerably less when using organic materials than it is with the inorganic mixtures of salts. The plant food in the organic materials, however, is much more slowly available than it is in the inorganic salts. This means that immediate stimulation of the growth of grass is not so striking with the organic materials. In fact, it may take two or three years to build up the fertility of the soil when using only organic fertilizers.

The organic fertilizers tend to encourage white clover and do not suppress the weeds so well as do the inorganic commercial fertilizers. On one series at the Arlington Experiment Farm, for instance, an organic mixture (9-9-4) applied in the spring and fall, at the rate of 1.25 lbs. of nitrogen to 1,000 sq. ft., reduced crabgrass from 26% in 1934 to less than 3% in 1939 and encouraged clover until in 1939 it comprised 40% of the total vegetation on the plots. Other weeds were reduced from 58% to 32% in the same period of time. On the other hand, an inorganic mixture of the same grade applied at the same rate reduced the weeds other than crabgrass from 58% in 1934 to 14% in 1939, and entirely suppressed the clover.

Clover is definitely a nuisance on golf course areas; whereas many people find it desirable on lawns. When it is considered desirable it will be encouraged by the organic materials and also by lime. In turn it will be able to use the free nitrogen in the soil because of the nitrogen-fixing bacteria in its roots. In this way it can definitely be used as a source of nitrogen; since either its roots or its tops, when decayed in the ground, release the nitrogen in a form available to grass and other plants present. Consequently, when white clover is not objectionable it may be wise to encourage it—particularly in these times, when it is not possible to get inorganic nitrogen fertilizers.

When To Apply Fertilizers.—Fertilizers in general should be applied to established turf at a time when they will stimulate the grass most and encourage the weeds least. Kentucky bluegrass, as well as most of the grasses that are used in the Cool Humid Region of the United States, grows most vigorously when the nights are cool and the days are warm, as in the fall and early spring. When inorganic fertilizers are applied in the spring, however, they not only encourage the growth of grass but also stimulate a vigorous growth of weeds, particularly annual weeds such as crabgrass. If the inorganic materials are used in the early fall, after the growing season of the summer weeds is over, they will stimulate the growth of bluegrass at a time when it will not suffer from competition with weeds. A dense turf produced in the fall is the best insurance against weed invasion the following spring and summer.

In the most northern states where snowmold is a menace, fall applications of fertilizer are not advisable, because the snowmold attacks more vigorously the grass which is producing a luxuriant growth at the time cold weather comes. In those parts of the



The dark area indicates vigorously growing Kentucky bluegrass on the marked plot which had received one application of mixed fertilizer at the rate of 1½ lbs. of nitrogen and 1¼ lbs. of phosphoric acid to 1,000 sq. ft. The unfertilized turf in the foreground and background appears light in color because of the dead crabgrass from the preceding summer with which the bluegrass had been unable to compete successfully. No seed was used. The picture was taken in April following the application in October

country, therefore, the best time to apply fertilizer is in the spring or early summer. Also in the South, where the summer grasses such as Bermuda grass, centipede grass, and the carpet grasses are dominant, spring is the time to fertilize rather than the fall.

How Much Fertilizer To Apply.—Established turf should receive annually sufficient fertilizer to supply at least 1 and preferably 2 to 2.5 lbs. of nitrogen for every 1,000 sq. ft. When inorganic materials are used, not more than 1½ lbs. of nitrogen (15 lbs. of a 10-6-4 mixture) should be applied at one time; and that should be applied when the foliage is dry and the air cool to prevent burning the grass. If more than this is to be applied it should be done in two applications, one in the late summer or early fall and the other in late winter or early spring. If desired, two applications might be made in fall or two in spring, with at least a two-week interval between applications. When new areas are to be seeded, it is desirable to work into the top few inches of soil sufficient fertilizer to furnish 2 lbs. of nitrogen to 1,000 sq. ft. If the soil is particularly poor, twice that amount would be desirable.

Use of Lime.—The application of lime is sometimes required, particularly on acid soils. Quickly made soil tests will indicate the lime requirements. There is, however, a tendency in many sections of the country to overemphasize the importance of lime. For instance, many people believe that because Kentucky bluegrass thrives in the limestone country of Kentucky, it can not grow unless lime is applied each year. Except on very acid soils, an application every 3 or 4 years of ground limestone applied at the rate of a ton to the acre, or 25 lbs. to 1,000 sq. ft., should take care of the lime requirements of the turf. When not necessary, it should be avoided, since it encourages many weeds and clover. When the lime is applied to established turf, it is wise to wait at least two weeks between applications of fertilizer and limestone, to avoid any chemical reaction with its consequent injury to the turf or loss of essential plant foods. A good time to apply the lime is late fall so that the alternate freezing and thawing during winter and early spring may carry it down into the soil. When organic fertilizers are used, the lime requirements will probably not be so high as when the inorganic salts are used, because the latter frequently have an acidifying influence on the soil.

Controlling Turf Pests

Some of the most perplexing problems connected with the maintenance of turf are those of controlling weeds, insects, and disease. Space does not permit a discussion of these except to present the general principles involved.

Weed Control.—So far as weeds are concerned, the old adage, "An ounce of prevention is worth a pound of cure," is applicable. A tough, dense, vigorously growing, disease-free turf is the best insurance against weed invasion. On large areas, proper fertilizing, mowing, and watering practices will go a long way toward encouraging the desirable grasses and discouraging the weeds and weedy grasses. On small areas, these practices can well be supplemented by the removal of new weed seedlings by hand, as soon as they appear and before they become firmly established.

Where existing turf has been seriously overrun by weeds, it is frequently advisable to kill the weeds with chemical weed killers rather than to plow the ground and reseed. The latter procedure, in addition to being more drastic, more expensive, and more time-consuming, will result in bringing to the surface weed seeds which are harmlessly dormant at lower depths. Many types of chemicals have been shown to be selective in their killing effect if used in sufficiently small quantities, with the result that plantain, dandelions, chickweed, crabgrass, knotweed, and many others can be killed without permanent injury to the

Spraying the football field at Lehigh with arsenicals to control weeds. Cultural control had been ineffective and hand weeding was too expensive

turf grasses. Most of the chemicals can be applied in solution as a fine spray or dry mixed with sand. Because the spray is usually more effective, it requires smaller amounts of the chemical; but it should also be remembered that the spray will likewise be more likely to injure the grass. Treatments with weed killers must be accompanied by fertilizing and raking or discing in seed.

Since the weed killers are likely to injure the grass temporarily, they should be applied in late summer or early fall, when the grass will be likely to recover most quickly with the minimum competition from new weed seedlings. Applications to turf in the late spring or summer are not so likely to succeed because the grass cannot recover so quickly; and while it is still suffering from temporary injury, new weed seedlings can become established. If spring applications seem necessary they should be made at lighter rates than in the fall. If one application is not sufficient, the dose can be repeated at 10-day intervals or whenever the grass has had a chance to recover. Often it is well to make the later applications at half the rate used the first time. Whatever chemical is used, it should be tested on a small scale on 50- or 100-sq.-ft. plots before large-scale treatments are undertaken.

Among the chemicals which have been found to be most generally successful are sodium arsenite, arsenic acid, and a commercial preparation which is a sodium di-nitro ortho cresyllate. The arsenicals should be applied in a fine spray at rates not exceeding 2 to 4 oz. to 1,000 sq. ft. The cresyllate compound should be applied according to directions either as a 1% or 2% solution, depending on the weeds which are to be killed. For the duration of the war, however, the arsenicals and perhaps many of the other herbicides may not be available for the control of turf weeds.

Insect Control.—There are many insects which spend at least one stage of their life in turf. The Japanese beetle and the June bug usually feed in the grub stage on the grass roots just below the surface of the soil. When present in sizable numbers they may completely destroy turf. Sod webworms, cutworms, army worms, and similar worms may also be injurious to turf. All of these, however, are controlled with arsenate of lead. For the beetle grubs, it should be applied to the soil mixed in sand at the rate of at least 5 lbs. to 1,000 sq. ft. An application at the rate of 10 lbs. to 1,000 sq. ft. may be expected to be effective for as long as 5 years. For the sod webworms, cutworms, and army worms, the arsenate of lead should be sprayed in solution at the rate of $1\frac{1}{2}$ to 2 lbs. to 1,000 sq. ft. The foliage, particularly

Control of narrow leaf plantain with a commercial cresyllate compound. The picture was taken in June. The preceding fall the plot on the right had received 4 treatments with a 1% solution between August 26 and October 9. The plot on the left was not treated

the leaf bases, must be well coated with the poison, since that is where they feed. Sucking insects such as chinch bugs cannot be killed by stomach poisons and must therefore be controlled by contact poisons such as derris root, rotenone, pyrethrum, or tobacco dust.

Disease Control.—Most of the diseases which attack turf grasses are caused by fungi, the spores of which require moisture to germinate. The fungi grow best in soft succulent grass leaves. It is important to avoid the development of lush, succulent growth at the time when diseases are likely to occur. As has been mentioned earlier, snowmold attacks may be reduced or possibly avoided in the North by not fertilizing the grass in the fall. On the other hand, farther south in the Cool Humid Region, where attacks of leaf spot or Pythium are likely to occur in late spring or summer, it is important not to encourage a lush growth during the spring growing season. Excessive watering, also, should by all means be avoided at this time, since the humid conditions resulting from constant sprinkling during warm weather furnish ideal conditions for the development of the fungi. Also, when disease attacks are imminent it is wise to raise the mower blades to cut the grass at a height of 2 in. in order to prevent any injury which the grass might experience from close cutting during hot weather.

In areas where the bents predominate in turf, attacks of dollarspot and brownpatch may occur. These diseases can be controlled by mercury fungicides such as bichloride of mercury or calomel, applied at the rate of 2 or 3 oz. to 1,000 sq. ft. at whatever intervals may be necessary to keep the disease under control. Since mercury cannot be used in turf fungicides for the duration of the war, however, another chemical known as tetramethyl thiuramdisulfide has been shown to control dollarspot, brownpatch and snowmold when either applied dry and mixed with sand or sprayed on in an aqueous solution.

Mowing Practices

The frequency and height of cut are determined principally by the kind of grass; time of year and climatic conditions; and presence or absence of disease. For the good of the grass plants, turf should be maintained as nearly as possible at a constant height. This necessitates more frequent cutting, but it should be done rather than to permit the grass to grow 2 or 3 in. high and then cut it down to half an inch, a practice which results in serious defoliation and injury to the grass.

Where lawns are composed principally of Kentucky bluegrass, fescue, or redtop, the most satisfactory height in spring and fall when the grass is growing vigorously is 1 to 1½ inches. In summer, when growth is much slower and conditions are ideal for attacks of disease and the invasion of annual weeds such as crabgrass, it is better to keep the grass at about a 2-in. height, since the taller grass is more resistant to disease and discourages the invasion of crabgrass. In New England and the Northwest, where bents can be used satisfactorily for lawns, the grass should be kept at a lower cut to prevent the formation of mats—particularly when the grass creeps vigorously by means of stolons.

When grass is cut the clippings should be allowed to return to the turf, since they contain more than 3% of nitrogen, about ¼ as much of phosphoric acid, and about 2% of potash. However, if the grass is permitted to grow long between cuttings, the clippings may be too heavy to permit them to fall without danger of smothering the grass. This is another argument in favor of frequent light clippings when labor and equipment are available.

To reduce the cost of mowing on large areas, care should be used in placing trees and shrubs so that specimen plantings do not interfere with the use of power mowers. Cutting around such specimen plantings must be done by hand or the grass on the areas allowed to grow long and straggly. The first alternative results in unnecessary costs and the second in eyesores which defeat the original artistic purpose of the plantings.

Watering

A final word of caution should be given concerning the watering of lawns. As has been indicated in the preceding discussions, many of the difficulties encountered in the maintenance of lawns can be traced to over-watering. Over-watering, particularly in the form of frequent sprinklings, encourages the development of moisture-loving weeds such as crabgrass, and furnishes a humid atmosphere immediately around the grass leaves which stimulates the development of disease-producing organisms. Also, frequent light sprinklings tends to cause the development of a shallow root system which is quickly injured if permitted to dry out. In periods of prolonged drought when watering seems indispensable, occasional thorough soakings which wet the soil down to a depth of 3 or 4 inches should be given, rather than frequent light sprinklings.

LANDSCAPE ARCHITECTS FOR UNIVERSITY AND SCHOOL PROJECTS

The following directory is restricted to Landscape Architects who are in independent professional practice and have actually been identified with a number of university or school projects.

Space limitations permit only three listings for each individual or firm, and preclude mentioning either the name of the architect associated or the definite character of the work undertaken for each institution. It is believed that the majority of landscape architects specializing in school and university work are here represented, and that many of the projects listed have had a considerable influence on high-grade professional practice in the planning and planting of school grounds and college campuses throughout the United States.

ARKANSAS

Neil Hamill Park, Parkin, Ark.

CALIFORNIA

Charles G. Adams, 440 Arroyo Drive, South Pasadena
Pasadena Junior College, Pasadena
Pasadena Public Schools, Pasadena
University of California Arabian Horse Ranch, Pomona

Katherine Bashford & Fred Barlow, Jr., 816 West 5th St., Los Angeles
Central Junior High School, Los Angeles
Harbor Hills, Palos Verdes
Ramona Gardens, Los Angeles

Ralph D. Cornell, 3723 Wilshire Blvd., Los Angeles
Pomona College, Claremont
University of California at Los Angeles
Santa Monica Junior College

John William Gregg, University of California, Berkeley
Campus development for the University of California at Berkeley and Los Angeles, Mills College, Oakland

Ned S. Rucker, 2025 10th Avenue, Oakland

Harry W. Shepherd, 821 Shattuck Ave., Berkeley

Ralph T. Stevens, 116 E. Sold St., Santa Barbara

Butler S. Sturtevant, 210 Post St., San Francisco
University of Washington, Seattle, Wash.
Principia College, Elsah, Ill.
Principia School, St. Louis, Mo.

Paul G. Thiene, 728 S. Arroyo Blvd., Pasadena, Cal.

R. D. Van Alstine, 3940 Myrtle Ave., Long Beach
James A. Garfield Classroom Bldg., Long Beach

CONNECTICUT

Charles A. Currier, 967 Farmington Ave., W. Hartford
Parking Area for Palmer Auditorium, Conn. College, New London
Faculty Group, Conn. College, New London
Palmer Library, Conn. College, New London

Thomas H. Desmond, Inc., Office of, 1 Drake Hill Rd., Simsbury
U. S. Coast Guard Academy, New London
University of Connecticut, Storrs
Simsbury High School, Simsbury

Joseph F. Whitney, Belden Hill, Wilton

GEORGIA

Alan F. Boyce, 500 W. Cambridge Ave., College Park

ILLINOIS

Fitzgerald & Atkinson, Glenview

Robert Bruce Harris, 664 North Mich. Ave., Chicago
Marshfield Senior High School, Marshfield, Wis.
Biles Township Community High School, Skokie
School District No. 69, Cook County

Chance S. Hill, 1333 Maple Ave., Downers Grove
Ill. Normal University, Normal
Blackburn College, Carlinville
Northern Illinois State Teachers College, DeKalb

Simonds, West & Blair, 1101 Buena Ave., Chicago
Monticello College, Alton
Chicago Latin School, Chicago
Blackburn College, Carlinville

F. A. Cushing Smith & Associates, 333 North Michigan Ave., Chicago
Board of Education, High School Athletic Field, Marquette, Mich.
Community Recreation Center, High School Athletic Field, Ishpeming, Mich.
St. Agnes School, Albany, N. Y.

INDIANA

Donald B. Johnston, 914 Architects & Builders Bldg., Indianapolis

IOWA

P. H. Elwood, Landscape Studio (I. S. C.), Ames
St. Amelian's School, Milwaukee, Wis.
Iowa State College, Ames
Iowa State University, Iowa City

LOUISIANA

William S. Wiedorn, 1305 Jackson Ave., New Orleans
Tulane University, New Orleans
John McNeese Junior College, Lake Charles
Terrebonne Parish High School and Athletic Field, Houma

MAINE

Beatrix Farrand, Reef Point, Bar Harbor
Yale University, New Haven, Conn.
Princeton University, Princeton, N. J.
Chicago University, Chicago, Ill.

DISTRICT OF COLUMBIA

Joseph C. Gardner, 7110 Clarendon Rd., Bethesda
Woodrow Wilson High School, Washington, D. C.
Ellen Wilson Low-Cost Homes, Washington, D. C.
Lisner Home for Aged Women, Washington, D. C.

MARYLAND

Irving W. Payne, 4017 Leland St., Chevy Chase
Georgetown Preparatory School, Garrett Park
The Miss Madeira School for Girls, Greenway, Va.
Lanham Grade School, Lanham

Office of H. Clay Primrose, 10 W. Chase St., Baltimore
Goucher College, Baltimore
St. Charles College, Baltimore
Woodstock College, Baltimore

MASSACHUSETTS

Herbert J. Kellaway, 12 West St., Boston
Uxbridge Field, adjoining High School, Uxbridge
Middlebury College, Middlebury, Vt.
Bread Loaf English School, Middlebury, Vt.

R. Newton Mayall, 50 Beacon St., Boston
Bradford Junior College, Bradford
Bowdoin College, Brunswick, Me.
Tilton Academy, Tilton, N. H.

John Nolen, Office of, 5 Boylston St., Harvard Square, Cambridge
Babson Institute, Wellesley
Queens College, Charlotte, N. C.
University of Wisconsin, Madison, Wis.

Olmsted Brothers, 99 Warren St., Brookline
Grove City College, Grove City, Pa.
St. Joseph's College, West Hartford, Conn.
Indiana University, Bloomington, Indiana

Bremer W. Pond, 5 Boylston St., Cambridge
Colby Junior College, New London, N. H.
University of New Hampshire, Durham, N. H.
Southern Methodist University, Dallas, Texas

Arthur A. and Sidney N. Shurcliff, 14 Beacon St., Boston
Amherst College, Amherst
Mount Holyoke College, South Hadley
Groton School, Groton

Fletcher Steel, 7 Water St., Boston

Wayne E. Stiles, Babson Park

Bradford Williams, 9 Park St., Boston
Warrenton Country School, Warrenton, Va.

MICHIGAN

Edward A. Eichstedt, 737 Chalmers, Detroit

T. Glenn Phillips, 1101 Charlevoix Bldg., Detroit
Michigan State College, East Lansing
Horace H. Rackham, Educational Memorial, Detroit
Charles Housing Project, Detroit

H. O. Whittemore, 331 Arch Bldg., University of Michigan, Ann Arbor
Ann Arbor Public Schools
Nichols Arboretum, University of Michigan, Ann Arbor
Hartland Consolidated School, Hartland

Wilcox & Laird, 1564 Penobscot Bldg., Detroit
Duns Scotus College, Detroit
Grosse Pointe High School, Grosse Pointe
Plymouth Public Schools, Plymouth

MINNESOTA

Hugh Vincent Feehan, 1004 Marquette Ave., Minneapolis
St. Thomas College, St. Paul
College of St. Scholastica, Duluth
Deep Haven High School, Deep Haven

Morrell & Nichols, Inc., 1200 Second Ave., South, Minneapolis
University of Minnesota, Minneapolis
Washington State College, Pullman, Wash.
Carleton College, Northfield

MISSISSIPPI

***Herbert B. Campbell,** 909 North St., Jackson (719 South St. Asaph St., Alexandria, Va. for the duration)
John Carroll University, Cleveland, Ohio
All School Grounds (12), Jackson
Mississippi War Memorial, Jackson

MISSOURI

Charles F. Dickinson, Lincoln University, Jefferson City

Hare & Hare, 114 W. 10th St., Kansas City
University of Kansas City, Kansas City, Mo.
Athletic Center and Stadium Setting, Houston, Texas
63 Schools, Fort Worth, Texas

John Noyes, 611 Olive St.
Ladue School, Ladue
Webster Groves Schools, Webster Groves
Lincoln University, Jefferson City

NEW JERSEY

Brinley & Holbrook, 21 S St., Morristown
New Jersey State Teachers College, Trenton
New Jersey State Hospital, Marlboro
State Training School for Girls, Totowa

Michael M. Burris, 485 Engle St., Englewood
Dwight Morrow High School, Englewood
Teaneck High School, Teaneck

***Oliver A. Deakin,** 1424 Clinton Ave., Plainfield

Frederic C. Hoth, 396 Allaire Ave., Leonia
Academy of the Holy Angels, Fort Lee
St. Cecelia High School, Englewood
St. Vincent De Paul, Bayonne

NEW YORK

Sheffield A. Arnold, Inc., 455 W. 23 Street, New York
Manhasset Grade School, Manhasset
East Park Junior-Senior High School, East Park
Huntington Senior High School, Huntington

A. F. Brinckerhoff, 101 Park Ave., New York
Trinity College, Hartford, Conn.
Millbrook School for Boys, Millbrook
State Training School for Feeble Minded, Southbury, Conn.

Harold A. Caparn, 144 E. 30 St., New York
Lebanon Valley College, Annville, Pa.
Brooklyn College, Brooklyn
Brooklyn Botanic Garden, Brooklyn

Laurie D. Cox, 136 Kensington Place, Syracuse
Whitesboro Central School, Whitesboro
Hartsdale School, Westchester Co.
Chancellor Livingstone School, Hudson

Alling S. DeForest, 16 Fair Place, Rochester
High School and North Street School, Geneva
Villa de Chantal, Rock Island, Ill.
Colgate-Rochester Divinity School, Rochester

Bryant Fleming, The Academy, Wyoming, N. Y.

Alfred Geiffert, Jr., Office of, 101 Park Ave., New York
University of Illinois, Urbana
Hunter College, N. Y.
New Jersey College for Women, New Brunswick, N. J.

Francis Hastings Gott Associates, 920 Merchants Rd., Rochester
East Bloomfield High School, East Bloomfield
Union Free School District No. 1, Brighton
Nazareth College, Pittsford

William E. Harries, 110 Franklin St., Buffalo
Ripley Central School, Ripley
North Park School, Lockport
Corfu Central School, Corfu

Helen Swift Jones, 101 Park Ave., New York
Adelphi College, Garden City
Avery Convalescent Hospital, Hartford, Conn.
Prospect Heights Hospital, Brooklyn

Roeder J. Kinel Associates, 438 Delaware Ave., Buffalo
Evangelical Training School, Dunkirk
Batavia High School, Batavia
Masten Park School, Buffalo

Charles Downing Lay, 101 Park Ave., New York
High School, Greenbush
Lenox School, Lenox, Mass.
New York State Normal Training School, Cortland

H. B. Littlefield, Box 288, North White Plains
Central High School, Hancock
High School and Stadium, White Plains
Battle Hill School, White Plains

William Pitkin, Jr., 2045 East Ave., Rochester
University of Michigan, Ann Arbor, Mich.
Kalamazoo College, Kalamazoo, Mich.
University of Rochester, Rochester

Miss Alice Recknagel, 101 Park Ave., New York

N. A. Rotunno, Professor of Landscape Architecture, Syracuse University, 120 Dorset Road
Syracuse University, Syracuse
Genoa Central School, Genoa

Richard Schermerhorn, Jr., 342 Madison Ave., New York
St. Joseph's College for Women, Brooklyn
Albany Academy, Albany
Rensselaer Polytechnic Institute, Troy

Jacob John Spoon, 128 Greenacres Ave., White Plains
Academy of St. Joseph-in-the-Pines, Brentwood
Penn. Township School Dist. High School Grounds, Bernville, Pa.
Central School District No. 1, Pine Plains

A. Carl Stelling, 101 Park Ave., New York
Athletic and Recreation Grounds, Bronxville
Mahopac Central School Grounds, Mahopac
Wappingers Central School Site, Wappingers Falls

Thomas Lyon White, 445 S. Warrant St., Syracuse
Cato-Meridian School, Cato
Middlesex Valley Central School, Rushville
Hartford Central School, Hartford

NORTH CAROLINA

E. S. Draper Associates, 2038 Beverley Dr., Charlotte
Winthrop College, State College for Women, Rock Hill, S. C.

Clarence M. Leemon, Charlotte

R. J. Pearse, Falls Rd., Route No. 1, Raleigh
Needham Broughton High School, Raleigh
Merideth College, Raleigh
Birmingham-Southern College, Birmingham, Ala.

R. D. Tillson, 222 Hillcrest Dr., High Point
Greenville Senior High School, Greenville, S. C.
High Point College Athletic Fields and Stadium, High Point
High Point Junior High School, High Point

OHIO

Alexander & Strong, 4500 Euclid Ave., Cleveland
Kent State University, Kent
University School, Shaker Heights
Mentor Village School, Mentor

Raymond W. Blanchard, Chief, Div. of Design, Cincinnati Public Recreation Commission, 3433 Clifton Ave., Cincinnati
Walnut Hills High School Recreation Area
Western Hills High School Recreation Area Airport

Hannah I. Champlin, Elsetta Gilchrist and Lucile Teeter Kisack, 4500 Euclid Ave., Cleveland
High School, Salem
High School, Little Valley, N. Y.
Forest Lawn Memorial Chapel, Youngstown

L. G. Linnard, 618 Pierce St., Maumee
Maumee High School, Maumee
Maumee Valley Country Day School, Toledo
Tau Beta Camp, Detroit and Lapeer

Charles R. Sutton, 5812 Olentangy Blvd., Worthington
Ohio State University Golf Course, Columbus

A. D. Taylor, 4614 Prospect Ave., Cleveland
Oregon State University, Corvallis
Carnegie Institute of Technology, Pittsburgh, Pa.
Notre Dame College, Cleveland

OKLAHOMA

The Classen Company, 301 Terminal Bldg., Oklahoma City
Emerson School, Lawton
Naval Training School, Norman
Naval Free Gunnery School, Lexington

PENNSYLVANIA

Russell Van Nest Black, Huffnagle Road, New Hope

John R. Bracken, Professor of Landscape Architecture, Penn. State College, State College
Indiana State Teachers College, Indiana
Laurelton State Village for Women, Laurelton
Pennsylvania Industrial School for Boys, Whitehill

Loutrel W. Briggs, Pennstone, Doylestown
Dobbs Ferry High School, Dobbs Ferry, N. Y.
Highland School, Pelham, N. Y.
Tannersville School, Tannersville, N. Y.

James Bush-Brown, Architects Bldg., Philadelphia
School of Horticulture, Ambler
Glenwood Housing Project, Philadelphia
Abbotsford Housing Project, Philadelphia

Harry B. Hostetter, Box 566 (R.R. 3), Lancaster
Reformed Theological Seminary, Lancaster
Linden Hall Seminary, Lititz
Pennsylvania Soldiers' Orphan School, Scotland

T. M. Kohankie, Professional Bldg., Pittsburgh
Homeville Junior High School, Mifflin Twp.
Emerson Elementary School, Mifflin Twp.
Lebanon Junior High School, Mifflin Twp.

***McCloud & Scatchard,** 217 S. High St., Mechanicsburg
Lock Haven State Teachers College, Lock Haven
Bloomsburg State Teachers College, Bloomsburg
Lititz Public School Grounds, Lititz

Thomas W. Sears, Girard Trust Bldg., South Penn Square, Philadelphia
Johns Hopkins University, Baltimore
Penn. State College, State College

Wheelwright & Stevenson, 225 S. 15th St., Philadelphia
The Gunnery School, Washington, Conn.
St. Andrews School, Middletown, Del.
Muhlenberg College, Allentown

SOUTH CAROLINA

Albert Schellenberg, 817 Henderson St.
High School, Titusville, Fla.
High School, Holly Hill, Fla.
Marine Research Laboratory, Edisto Island

TEXAS

C. Coatsworth Pinkney, 5512 Shoalwood Ave., Austin
School, Bastrop
City Hall, Bonham
Austin-Travis Country Sanitarium, Austin

VIRGINIA

Albert A. Farnham, 1240 White Oak Rd., Roanoke
The Virginia Polytechnic Institute, Blackburg
Hollins College, Hollins
Warren County High School, Front Royal

Charles F. Gillette, 105 E. Cary St., Richmond
Bennett College, Greensboro, N. C.
Washington and Lee University, Lexington
St. Giles Church, Richmond

WASHINGTON

Edwin Clair Heilman, 715 Lloyd Bldg., Seattle

WISCONSIN

Annette Hoyt Flanders, 524 E. Mason St., Milwaukee, Wis.

Phelps Wyman, 759 N. Milwaukee St., Milwaukee
State Industrial School for Girls, Oregon
Central and West Grade Schools, Rhinelander
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O. M. Scott & SONS COMPANY

Turf Service for Schools

Dept. WPOST Marysville, Ohio

Lawn Care

FREE BULLETIN SERVICE

Grass growing presents many and intricate problems—most of which someone has solved.

In the little bulletin called LAWN CARE you will find the answers to your turf questions. It doesn't represent what one or a dozen persons think about a lawn problem. It is a condensation of the experiences of hundreds of competent authorities and laymen.

If you are not already receiving LAWN CARE, just let us know. A full set of all bulletins to date will be sent in loose-leaf binding without charge or obligation. Future bulletins will be brought to you 5 times yearly by the postman. No salesman will call.

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Scotts Seed is known the country over for its dependable quality. It has produced fine turf on more than 1600 golf courses and is the preference of scores of colleges, universities and high schools for their athletic and campus areas.

ATHLETIC FIELD MIXTURE if you want tops in turf on a field you're proud to exhibit.

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CAMPUS MIXTURE available in top quality and also in a popular price quality.

SPECIAL MIXTURES for special places. Let us quote on any formula that you use.

SEPARATE GRASSES. As largest handlers of grass seed in U. S. we can quote attractive prices on good quality.

TURF BUILDER the special food for grass. You can have better turf and save money on seed by using this food.

COLDWELL LAWN MOWER COMPANY

America's Oldest Manufacturer of Lawn Mowers Since 1867

Newburgh, N. Y.

YOUR 1943 COLDWELL MOWER IS RIDING THE CONVOY LANES SOMEWHERE ON THE HIGH SEAS

All the manpower, facilities and resources of Coldwell are at work day and night delivering special equipment to our armed forces in ever increasing quantities. This we consider our duty for the duration.

In foregoing your order for a 1943 Coldwell mower you make it possible for us to do our part in the war effort.

You can do your part by properly caring for your present mower for the duration. Coldwell dealers and distributors will gladly supply you with genuine Coldwell replacement parts and service.

The new ideas and methods we are learning every day assure you of the finest lawn mowers obtainable in the future.

GRAVELY MANUFACTURING COMPANY

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Model L GRAVELY
with
Vee-Type Snow Plow

Schools and universities throughout the country recognize the distinct advantages of the GRAVELY—the **only** machine that solves so many upkeep problems.

1. **Mows Your Lawn**
2. **Cuts Tall Weeds and Grass**
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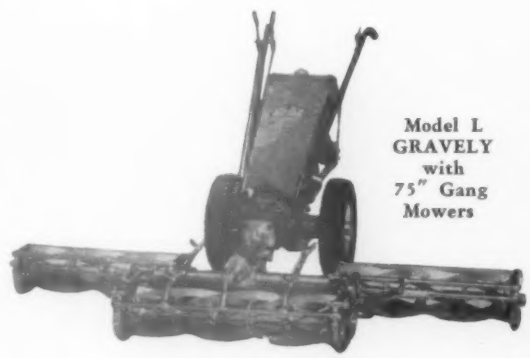

Model L
GRAVELY
with
75" Gang
Mowers

A YEAR-ROUND MACHINE

You buy ONE sturdy 5 H. P. Tractor . . then, change **power** attachments according to the job. With the GRAVELY **one** man does everything. . . .
A 30-inch Power Driven Rotary Mower for the lawns (power-driven gang units and riding sulky available for the larger areas) . . . a Power Sickle Mower for the rough spots and athletic fields. . . .
A power sprayer . . . A Power Pump . . . A cart for moving dirt . . . or odd jobs of hauling. . . . Both Vee and a Patented Reversible Blade Type Snow Plow capable of working in 12" of snow. Whatever the job, if you own a GRAVELY you have the equipment and sufficient power to do it.

FRUITS OF SPECIALIZATION

The GRAVELY is produced in a factory devoted to manufacturing nothing else. This includes making the motor as well. Each manufacturing operation is controlled. This means that each machine is produced as a complete unit, each part **designed to be** used with the others . . . **not an assembling proposition.**

The GRAVELY products are sold **and serviced** through Dealers, for all GRAVELY Dealers are qualified to render service on the machines they sell. Write us that you may check with our representative in your neighborhood. Like the product, you will find our sales policy practical . . . you are not asked to buy a machine without first being shown what it will do,—under your very own conditions.

EXCLUSIVE GRAVELY FEATURES

There is a 5 H. P. motor . . . **two** forward and reverse speeds . . . an automotive type differential . . . a worm gear drive running in oil . . . one spot lubrication system for both tractor and motor . . . NO CHAINS . . . an oil bath air cleaner . . . an oil filter to clean and strain the oil . . . a SAFETY SLIP CLUTCH individually incorporated into each power attachment . . . and many, many others.

Learn more about a machine that for TWENTY years has been improving the appearance of schools and universities and at the same time reducing upkeep costs.

Model L
GRAVELY
with
30" Rotary Mower

Ask for our catalog entitled:
"MAKING AND KEEPING A BEAUTIFUL LAWN"

Model L
GRAVELY
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ANCHOR POST FENCE COMPANY

Complete Line of Fences and Playground Equipment

6695 Eastern Ave., Baltimore, Md.
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ANCHOR FENCES FOR SCHOOLS AND SCHOOL PLAYGROUNDS

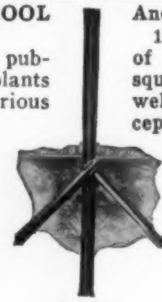
The Anchor Post Fence Company has been serving public schools and colleges, municipalities and industrial plants with fencing and playground equipment to suit their various requirements for half a century.

Anchor Chain Link Fences

Makers of America's first chain link fence, the Anchor Post Fence Company today manufactures a complete line, and will be glad to supply any interested school executive or architect with a copy of our Chain Link Fence Catalog containing full information about the four exclusive features which make an Anchor Chain Link Fence exceptionally attractive and durable. **Ask for Catalog No. 110.**

Anchor-Weld Iron Fences and Gates

Through the exclusive Anchor-Weld method of construction, the Anchor Post Fence Company is able to manufacture iron fences and gates which equal in appearance many expensive hand-wrought products. Many schools throughout the country are today justly proud of their beautiful Anchor-Weld Ornamental Iron Fences and Gates. Some of these are to be found illustrated in our **Catalog No. 111.**



Anchor Drive-Anchorage

Anchor's Four Exclusive Features

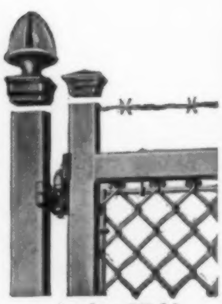
1. **ANCHOR-WELD WIRE GATE—built with a frame of square tubular steel—arc-welded at the corners. The square shape of the heavy steel tubing, together with the welding of the corners, provides a framework of such exceptional strength that no re-enforcing diagonal braces are needed. We claim that this is the strongest and most attractive wire gate made.**

2. **SQUARE TERMINAL POSTS—stronger because they are square in section. More protective—having no fabric-holding bands and therefore providing no footholds for climbing. Better-looking—because of their graceful lines.**

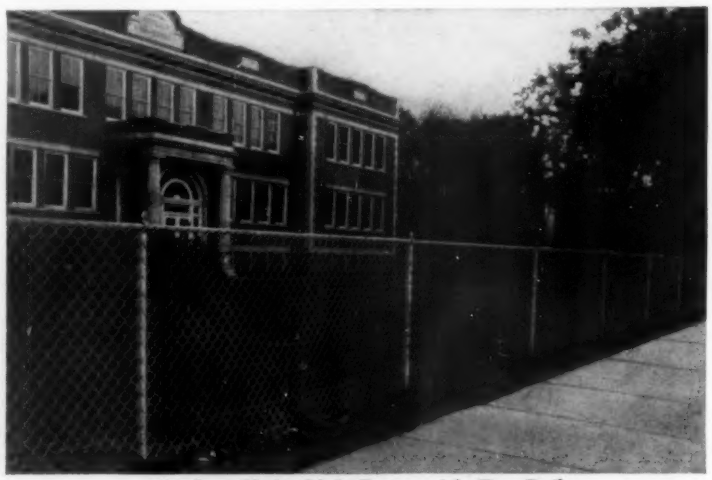
3. **U-BAR LINE POSTS—made of high carbon steel and U-shaped in section to insure maximum strength.**

4. **DRIVE-ANCHORAGE—grips the soil like the roots of a tree. We have imitated nature's engineering by providing the line posts with a broad foundation. Anchor drive-anchors defy thaws, frosts and the many other strains to which a fence is subjected.**

Note: While we strongly advocate the drive-anchor method of setting posts, we can, if desired, set our posts in concrete footings when conditions warrant such a procedure.

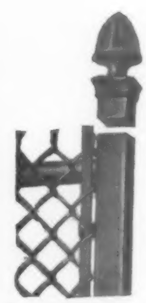


Anchor-Weld Wire Gate

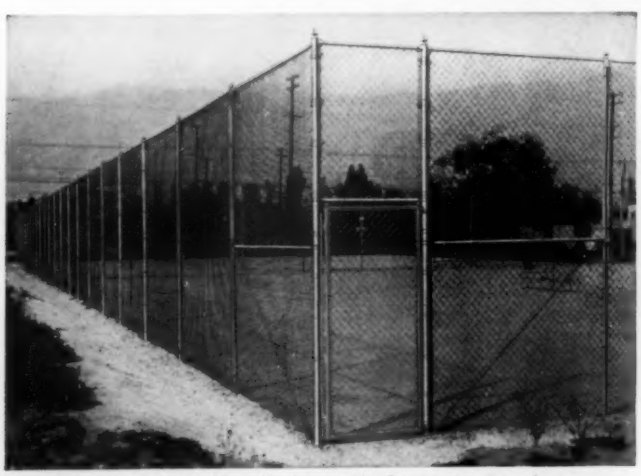


Anchor Chain Link Fence with Top Rail
High School, Mineola, N. Y.

Anchor U-Bar Line Post



Anchor Square Terminal Post



Anchor Chain Link Tennis Court Enclosure at Pasadena High School, Pasadena, Calif.

Anchor-Weld Fence Surrounding St. Anne's School, Fall River, Mass.

CONTINENTAL STEEL CORPORATION

Manufacturers of Chain Link Fence for All Purposes

General Office: Kokomo, Indiana

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Alexandria, Austin, Atlanta, Canton, Chicago, Columbus, Dallas, Dayton, Des Moines, Detroit, El Paso, Evansville, Ft. Wayne, Grand Rapids, Indianapolis, Kansas City, Louisville, Minneapolis, New Orleans, New York, Norfolk, Oklahoma City, Omaha, Philadelphia, Richmond, San Antonio, South Bend, St. Louis, St. Paul, Toledo, Tulsa, Wichita

COMPLETE CHAIN LINK FENCE

To meet the fencing requirements of schools and universities, Continental has developed a wide range of structural variations in its Chain Link fence. The selection in styles, heights, types of top construction, gates and accessories makes it possible for schoolmen to select the best fence for any installation.

MADE OF KONIK STEEL

FABRIC OF KONIK STEEL

The wire fabric in Continental Chain Link fence is made of KONIK—a new steel containing copper, nickel and chromium for greater strength and rust resistance "clear through." This superior fence fabric carries a zinc coating applied by a special hot dip process to insure uniformity and adhesion of the coating to the base steel. A uniform, bright finish enhances the appearance of Continental fence fabric. Wire is full gauge and woven in exact mesh.

> **NOTICE:** *During wartime, Continental Chain Link Fence is needed to protect war plants and military installations. Its sale is regulated by government rulings. Effective April 30, 1941, Continental Steel Corporation complied with OPM Division of Priorities Order No. M-5 (Nickel Bearing Steel) and discontinued adding nickel to steel used for Chain Link except where specified on a Defense Order.*

12 STYLES

Continental offers 12 styles of top construction for Chain Link fence. Six popular styles are illustrated to the right. Continental fence is engineered for each specific job.

POSTS AND FITTINGS

Continental fence has heavier, sturdier posts with improved brace construction. Top rails are joined by a special Inside-Outside coupling. Post caps and barbed wire arms are sturdy, heavier. Self-locking slots hold barb wire. New type lock pin eliminates bolts and nuts for fastening fabric to tension bands.

GATES

Strong and easily operated gates and locking devices. Single and double types with improved pivot type hinges. Manually or mechanically operated.

ENGINEERING AND ERECTION SERVICE

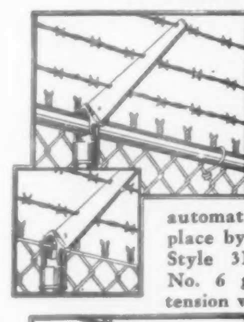
Our engineers are prepared to assist you in laying out the most economical installation for your purposes. Trained erection crews are available for correct and economical construction anywhere. When local labor is used Continental will supply competent foreman and inspection service.

SEND FOR FREE MANUAL

This file size book contains more than 100 illustrations, will help you evaluate fence protection, select right style of fence. Write the

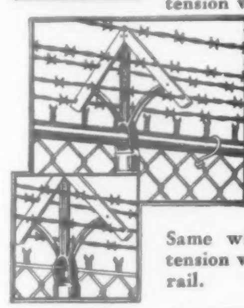
CONTINENTAL STEEL CORPORATION
KOKOMO, INDIANA

A STYLE TO MEET EVERY SCHOOL NEED



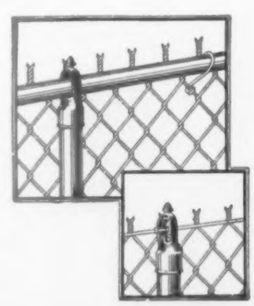
Style 3B - R— Three strands of barb wire with top rail. Arm of 12 gauge pressed steel. Barb wire held in angle slots and automatically locked in place by tension.

Style 3B-W— Same with No. 6 gauge coil spring tension wire instead of top rail.



Style 5B - R— Five strands of barb wire with top rail. Top rail of tubular steel $1\frac{5}{8}''$ O.D. Has 7" expansion sleeves.

Style 5B - W— Same with No. 6 gauge tension wire instead of top rail.



Style NB - R— No barb wire with top rail.

Style NB-W— Same with No. 6 gauge tension wire instead of top rail.

CONTINENTAL SUPERIOR STEEL

CONTINENTAL *CHAIN LINK* FENCE

OTHER CONTINENTAL STEEL PRODUCTS > STEEL ROOFING AND SIDING · FIELD FENCE · GATES · POSTS · BARBED WIRE · NAILS · LAWN FENCE · ETC. MANUFACTURER'S WIRE · GALVANIZED AND SPECIAL COATED SHEETS · BILLETS · SHEET BARS · WIRE RODS

CYCLONE FENCE DIVISION

(American Steel & Wire Company)

UNITED STATES STEEL

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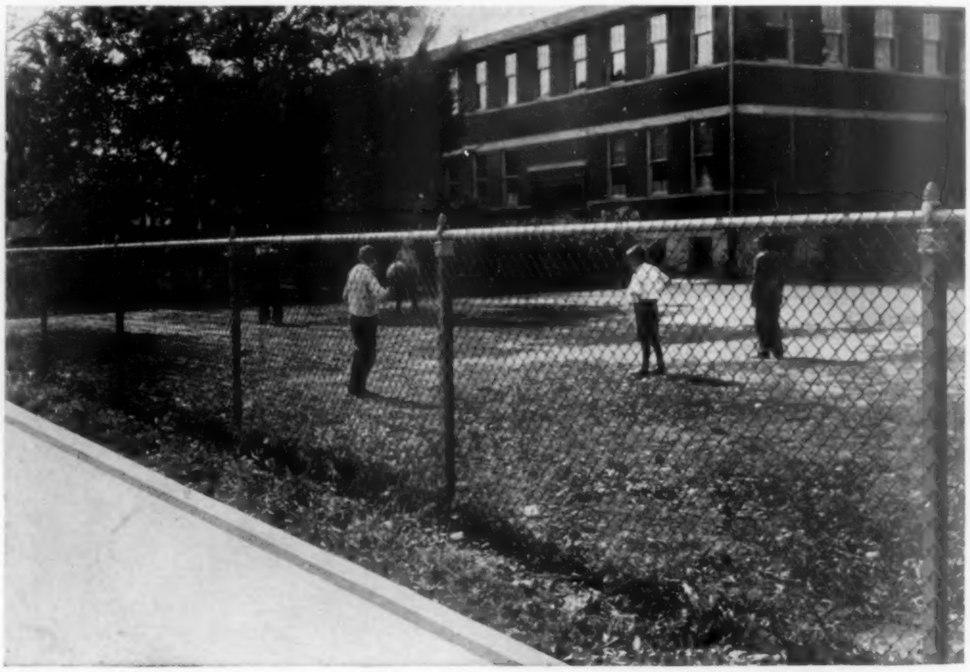
United States Steel Export Company, New York



Cyclone Safeguard Chain Link Fence for School Grounds, Playgrounds, Parks, Institutions, Etc.

CYCLONE FENCE is the economical, serviceable enclosure for school yards, playgrounds, athletic fields, outdoor pools. For years Cyclone has specialized in fencing school property. Cyclone Fence is the recognized standard for every school and playground purpose.

School grounds enclosed with U.S.S. Cyclone Fence provide maximum protection for your school children.

Athletic fields fenced with Cyclone get more paid admissions — for they permit complete control of crowds, efficient collection of tickets.

Because of its long, trouble-free service, you will find Cyclone Fence most economical in the long run. In every detail it is made for durability and long life.

Cyclone Fence has taken on a big job these days—guarding America's busy war plants. That's why you may not be able to get the fence you want just when you want it. But get the facts on Cyclone Fence now. Send for our free booklet: "Your Fence—How to Choose It—How to Use It." The 32-page book is packed with information you will want on Cyclone Fence, Tennis Court Enclosures and Window guards. Ask for a free estimate. We will let you know just as soon as we can provide the fence you need.

Cyclone Invincible Chain Link Fence for Athletic Fields

Cyclone Window Guards are sturdy—save money

THE STEWART IRON WORKS COMPANY

"Fence Builders to America Since 1886" INCORPORATED

1003 Stewart Block, Cincinnati, Ohio

PRODUCTS
- Bronze Tablets
- Chain Link Wire Fence and Gates
- Flag Poles
- Folding Chairs
- Folding Gates

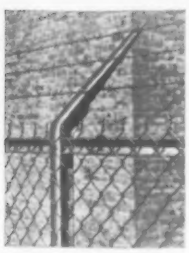
PRODUCTS
- Iron Fence and Gates
- Pipe Railing
- Settees
- Stadium Seat Brackets
- Window Guards
- Wire Mesh Partitions

FOR EVERY PURPOSE

Stewart offers Plain or Ornamental Iron and Chain Link Wire Fence and Gates for front, side and rear property lines; for athletic fields, tennis courts, recreation grounds and other school requirements.

Stewart Chain Link Wire Fence is the only ALL BEAM FRAMEWORK construction on the market.

Style 0TH Chainlink Wire Fence



Style 3TH

The Chain Link Wire Fence illustrations clearly show this exclusive feature. Notice the 3TH Oval-Back I-Beam Line Post with integral extension arm. Obviously this solid post is superior to pipe or other types of post requiring a separate pressed steel arm which may be removed or easily broken. Notice, too, that the beam top rail passes through the post itself—eliminating the need for fittings. The flat, smooth surfaces of Stewart All Beam construction offer maximum resistance to wear, weather and corrosion. This type of fence structure, exclusive with Stewart, is the heaviest and strongest manufactured.

Usual heights of style 3TH shown in illustration are 7 ft. and 8 ft. overall. All materials are of Copper-Bearing Steel hot-dipped galvanized after fabrication to assure greatest possible resistance to rust.

Iron Fence Installation, Erie, Pa.

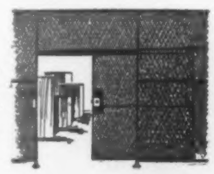
IRON FENCES AND GATES

For front property lines where dignity as well as protection is a requisite, Stewart offers a multiplicity of designs in plain or highly ornate iron. Here again Stewart construction is unique. The patented channel rail, exclusive with Stewart, adds immeasurably to the strength of the fence. All fittings are of Stewart design—the result of more than 56 years' experience and research in the fence building field.

METAL FOLDING CHAIRS

Built of strong steel channels. Full size seat with correctly pitched form-fitting back. Stewart Metal Folding Chairs are tip-proof. Standard finishes are: Black, Brown, Dark Green, Mahogany or Taupe. Literature and prices furnished upon request.

WIRE PARTITIONS



Effective and economical enclosures for locker rooms, stock rooms, supply rooms, tool rooms, machinery, power houses, etc. When writing for prices please send sketch giving measurements.

BACKSTOPS

Ideal for hard or soft baseball diamonds, tennis and badminton courts, etc. Sturdily constructed to stand the toughest abuse. Literature and prices furnished on request.

BRONZE PLAQUES

Plaques and tablets of hand-chased cast bronze, are available in stock sizes from 9" x 16" to 24" x 36". Special sizes will be made to order. Literature and prices gladly sent on request.

CATALOGS — SALES AND ERECTION SERVICE

Literature is available on all Stewart products. If interested in Chain Link Wire Fence ask for Catalog No. 79. If in Iron, ask for Catalog No. 81. When requesting catalogs, please indicate products in which you are primarily interested.

Stewart maintains sales and erection offices in all principal cities. Consult your local classified telephone directory or write direct to factory.

WICKWIRE SPENCER STEEL COMPANY

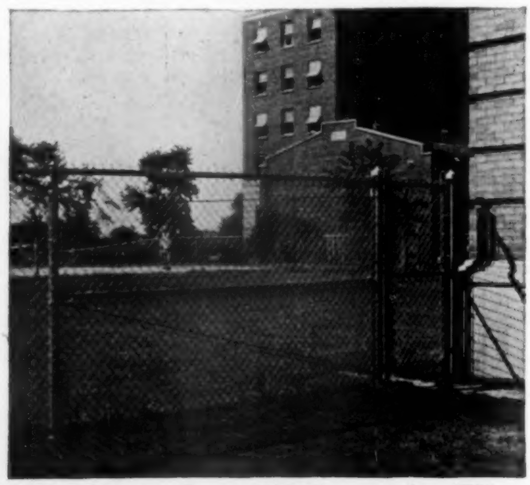
General Sales Office (Fence Dept.), 70 Niagara St., Buffalo, N. Y.

DISTRICT SALES OFFICES

New York City Chicago Worcester San Francisco Los Angeles Seattle

DISTRIBUTORS AND ERECTORS IN ALL PRINCIPAL CITIES

THE Wickwire Spencer Steel Company offers Chain Link Fences for all types of property, including schools, playgrounds, athletic fields, tennis courts, etc. Manufactured entirely in their own plants with complete control from mine to consumer. Sold with complete installation, or if preferred, we will furnish all necessary materials to be installed by others or with the services of a supervising foreman. All posts are furnished to set in concrete footings. (Concrete preserves the metals from corrosion below the surface.) All materials except non-ferrous metals are hot galvanized after fabrication.



Wickwire Spencer Type 420H Fence, using "H" section line, end, corner and gate posts. A design virtually foolproof as no bolts or nuts are exposed for possible tampering. Gates of similar construction using heavy square tubing with specially reinforced heavy hinges and locking devices. If desired, this type of fence is available with copper bearing pipe posts throughout.

Wickwire Spencer Tennis Court Design. Illustration shows a typical Tennis Court Fence design. Two types are available—310 (light construction) and 420 (heavy construction). Standard heights, 8', 10' and 12'.

Wickwire Spencer Type 425 Fence. Same as Type 423, except that five strands of barbed wire are used, supported by a triangular arm.

Wickwire Spencer Type 423 Fence with three strands of barbed wire. Illustration shows pipe posts throughout. Gates to match. This type is also available with "H" posts same as shown in Type 420H illustration, with gates of similar construction.

Write to this office direct, or to any of our district offices shown above, for catalogs, and full particulars. Distributors may be located near you. Ask us who they are. Estimates and engineering services will be furnished without any obligation on your part.

PITTSBURGH PLATE GLASS COMPANY

COLUMBIA CHEMICAL DIVISION

Grant Building, Pittsburgh, Pa.

Chicago • Boston • St. Louis • Pittsburgh • New York • Cincinnati • Cleveland • Philadelphia • Minneapolis • Charlotte

For year-round

PROTECTION

from the hazards of

DUST and ICE

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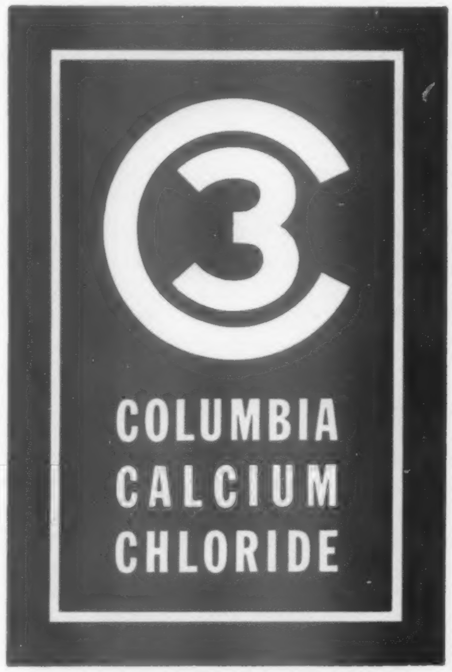


Columbia Calcium Chloride applied to tennis courts, playgrounds, driveways—wherever dust is a nuisance and a health hazard—pays important dividends in safety, comfort, and health. It provides positive dust-control. It is economical and easy to use.

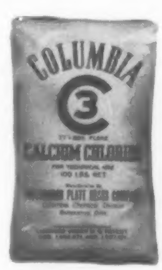
Because of the effectiveness of Columbia Calcium Chloride in absorbing moisture from the air, two applications per year are enough to assure a moist, compact, dust-free surface. One application should be made at the start of the dust season—a lighter one about six or eight weeks later.

During winter months, Columbia Calcium Chloride serves as an important safeguard against personal injury from icy walks and pavements. Even at zero temperatures, it melts ice from walks and stairways. Mixed with sand or cinders, it skidproofs drives and roadways much more effectively and quickly than untreated abrasives.

Columbia Calcium Chloride in the form of easily handled white flakes is packed in 100 lb. moisture-proof paper bags.

Columbia Cleaner and Cleanser

A white powder especially prepared for hand cleaning operations, including glass, china, walls, refrigerators and other equipment. It is widely used by schools, clubs, dairies, hospitals, and restaurants.



Columbia Detergent

This is a carefully prepared and blended cleaning mixture of the scouring type. It is especially suitable for large - area cleaning jobs such as enameled and painted surfaces, and tile or marble walls and floors.

● **Write today to our Pittsburgh office for special folders on these Columbia products, and for prices and name of your nearest distributor.**

SECTION V
PHYSICAL EDUCATION AND ATHLETICS

COLLEGE PHYSICAL EDUCATION FACILITIES FOR WAR AND PEACE

By E. D. MITCHELL

Chairman, Physical Education for Men, University of Michigan, Now Lieutenant Commander, U. S. N. R.

CERTAIN fundamental principles have guided the development of school and college facilities for many years. Some of these principles have been adopted by legislators, and have tended to standardize building construction. While legislation of this sort had considerable value in helping to maintain minimum standards for school-house building, the ensuing years often demonstrated that, in many cases, building codes tended to hinder the necessary progress in school design demanded by curricular changes.

It is of paramount importance that school facilities be adapted to our changing philosophy of education. We have come a long way from the time when education was considered solely "mental" in nature. Classrooms were sufficient then. With the acceptance of the idea of the biological unity of the school child came the need for facilities for more social, vocational, and physical activities. A new type of classroom was needed; so also were auditoriums, lunch rooms, clinics, shops, gymnasiums, swimming pools, playgrounds, and athletic fields. Since 1911 the developing philosophy of the school as a community center has led to radical changes in building design. It is likely that the community school will continue to become more and more the kind of educational institution that is required by the social changes which are coming with increasing rapidity both during and after the war.

Following the last war a tremendous impetus was given to school building. In the public school system many new junior high-school buildings were erected. These were far superior to the older senior high-school structures. As a consequence it was not unusual to see the newer schools used for community purposes and even for the already established school athletic events.

The depression of the 1930's also had its impact upon school building; to wit, the addition of units that would modernize old school buildings, as well as the construction of new ones. Funds from the federal W.P.A. and P.W.A. programs made these projects possible.

Trends in Physical Education Facilities

All these developments in school buildings were as noticeable in colleges and universities as in city public school plants. From the standpoint of gymnasiums, however, a more marked trend in colleges was toward the field house or combination field house type; and from the standpoint of outdoor athletic fields, greatly increased provision for facilities for recreative sports was evident. The change in gymnasium planning came with the emphasis on informal sports in the physical education program, as contrasted with the former emphasis on gymnastics of various types. The sport emphasis also necessitated provisions for spectators, something not necessary in the older gymnasiums, which featured only a gymnastic program. As for the general all-round emphasis in colleges on recreational sports, that was an outgrowth of the philosophy of education for leisure which took hold in the 1930's.

Influence of the War on Physical Education

World War II has put a temporary stop to almost any form of building construction that is not directly concerned with war demands. So far as physical education is concerned, it has definitely emphasized body conditioning or physical fitness. The long-range educational aims of physical education are temporarily shelved, as are the more purely recreational emphases in sports. We are geared to a mass production plan of physical fitness and of physical skills that have direct military value. Formal exercises adapted to large numbers of students are temporarily in vogue; in peace time they would not be popular, but today young men are lifting these exercises above the level of drudgery. They realize the need for physically hardened and skillful bodies when they enter the service, not only to withstand the rigors of military training but also to meet actual emergencies when their lives will be at stake.

In times of peace we would rather play for fun; today in a war of mighty forces, we are willing to consecrate our efforts to the call of duty; to develop our capacity for physical output in strength, skill, and endurance to the greatest extent possible and by the most economical method. We have voluntarily regimented ourselves to this purpose.

The Obstacle Course.—The watchword, therefore, for activities in the physical fitness courses of our

New York University students learn that crawling exercises are a feature of the obstacle course run

As at other schools, wall scaling is an important event of the obstacle course at Alabama Polytechnic Institute

Courtesy The Journal of Health and Physical Education

colleges and universities is that they be vigorous in nature. To the older methods of marching, calisthenics, combatives, games, and sports some newer methods of training have been devised. One is the so-called obstacle course. Practically all schools have devised some form of this device, which utilizes climbing, dodging, crawling, balancing, and jumping in circumventing obstacles. Many obstacle courses have been built to supplement the intensive programs of physical conditioning which have been adopted by many schools. Use has been made in such outdoor courses of the natural terrain and natural obstacles available in the college surroundings. Golf courses, rolling hills, creeks, sand, pits, trees, logs, and other natural barriers constitute obstacles which the students must overcome. The majority of these courses, however, have been built on athletic fields. They usually consist of pits over which the students jump, two-by-fours on which they balance themselves while running, zigzag courses or maze equipment, ropes to climb and swing on, walls to scale, hurdles to jump, barriers to crawl through or under, and suspended ladders on which to progress while in a hanging position. Much use is made of the so-called natural activities (running, jumping, climbing, hanging, and throwing) in these obstacle races.

It is reasonable to expect that the obstacle course will remain as an adjunct of athletic fields for some time after the war is over. Moreover, the obstacle course is being used also in indoor programs. Track hurdles, bucks, horses, low horizontal bars, ropes, ladders, and mats are used for the various phases of the obstacle race. Many interesting innovations can and have been made to serve as obstacles. There are possibilities here for the gymnasium designer who is planning for post-war needs.

Swimming Facilities.—Another wartime emphasis is on swimming, diving, jumping into the water, and life saving. The value of being able to swim cannot be overstressed. One can readily see that the ability to swim or to be able to maintain one's self in the water for long periods of time may mean the difference between life and death. It is fitting, then, that swimming should be considered an essential attribute of every individual's ability. Many schools have made swimming a requisite for graduation. Some schools have gone so far as to exclude a non-swimmer from other phases of the physical education program until he learns to maintain himself in the water.

The courage and ability to jump into the water from high places can save lives on sinking ships. Jumping from a height of sixty feet (the height of decks of some of our larger transports) requires considerable skill if injury or death is to be avoided. Obviously, we can rarely provide facilities to simulate exactly this kind of experience; we would not even if we could, because of the danger involved. We can, however, teach techniques of jumping into the water from high diving boards and towers. Equipment of this nature will be used increasingly in swimming pools. Some teachers are using the balconies overhanging pools for this kind of instruction.

The strong emphasis on swimming has led to a maximum use of our swimming facilities; in most cases, it has resulted in overcrowding of pools. Swimming pools that would easily take care of the usual student load before the war are now inadequate. The possibility of constructing new swimming pools is out of the question now because of priorities on materials and shortage of labor. We can do little at the present time but use our pools to capacity. Water purification systems have had to be "stepped up" to take care of the increased use of pools, and, in some cases, larger purification units have had to be purchased.

It is likely that there will be many pools built after this war. The ability to swim and to maintain one's self in water for long periods of time has been clearly indicated as an urgent need of military life, and this need extends to peacetime as well. Physical education will be justly brought to task if the large percentage of non-swimmers among our youth and adult population continues. This can only mean that more swimming facilities—both indoor and outdoor—must be made available for schools and colleges.

The Future of Swimming Pool Construction.—Several universities during the past decade have designed and built swimming pools to fit a specific use. Varsity teams, regular class groups, and non-swimmers each require a pool of different design. The program of instruction for each of these groups is quite dif-

ferent. Depth of water as a requirement for varsity and non-swimmer pools varies considerably. Spectator facilities are needed for varsity pools. College pools in the future will be constructed to meet the specific demands placed upon them.

Some pools now have underwater observation windows to facilitate teaching. The provision for such windows will be more widespread in the future.

The use of constructional materials, improved thermostatic control, and air conditioning to solve problems of pool acoustics, heat retention, and condensation reduction will receive much more consideration in years to come than they have been given. The matter of removing dampness is very important both from the standpoint of the health as well as the comfort of the spectators, who sit in street clothes throughout a meet; also of the attendants who must supervise the operation of the pool for long hours.

Widths of pools will undoubtedly be based upon multiples of seven feet, the standard width of swimming lanes.

Many of these suggestions are the results of the actual experience of Ohio State University.[1]

School Camping.—Before the war, considerable attention was being given to the possibilities of school camping. There is probably no single activity that involves more essential military skills than camping. Camping is recognized by prominent educators as an important addition to our changing school curriculum; unfortunately, most schools have not seen their way clear to provide sites, buildings, and equipment for camping experience for the children of their communities. The future will no doubt witness developments for camping as an integral part of American education. If so, then the school plant will include an adequate camp site—probably not on its immediate campus, but in woods and mountains within suitable distance to overcome transportation difficulties. Continuous use of camps will be made throughout the year by schools. It is probable that federal and state aid will be needed and provided to facilitate the development of school camps in America.

[1] H. D. Smith and M. Peppe, "The Natatorium at Ohio State University —Critical Observations After Nine Years of Use." *American School and University*, 1941. P. 254.

Health Services.—The war has brought also an intensified interest in the complete and periodic health examination and in the correction of remediable physical defects. This trend will certainly have its effect upon health service facilities in the colleges and universities of the future. It is probable that facilities and equipment for thorough treatment and correction will be made available to college students. Our failure to correct remediable defects in the past is due largely to the inability of students to finance treatment for themselves. Public responsibility may eventually be assumed to remedy this condition. When such a responsibility is recognized, college health services will have to be more completely equipped for therapeutic purposes.

Buildings for health service will be functionally planned; "any old space" will not do. Such facilities will be readily accessible to the student body and will be located in such a manner as to minimize noise. The building itself will be an example of healthful living. Adequate lighting, excellent ventilation, sufficient space, and immaculate cleanliness (not necessarily "whiteness") will characterize this particular facility.

Physical Education After the War

Community service will have its place in the physical education program of the future. As the public school becomes increasingly a center for community activities, so will the college and university break down their traditional barriers and become integral constituents of the communities in which they are located. Such a trend will have many implications for the use and design of physical education facilities.

More widespread adult recreation is one of the most urgent needs of our American life. As a significant phase of adult education, college recreational facilities will be used increasingly by the adult population, and the services of skilled college instructors in sports will be requested for extension classes. Facilities for sports adapted to adult needs will have to be provided. More space for such activities as handball, badminton, tennis, golf, riding, boating, archery, volleyball, and

The outdoor obstacle course at Alabama Polytechnic Institute features the suspended horizontal ladder

Alabama Polytech students on the chinning bar, equipment now regularly used in physical fitness programs

swimming will be required for adult use. Co-recreational activities will necessitate change in the design of facilities in order that they may be used by both men and women as well as the girls and boys in college. A community badminton club is one example. From a child-centered approach we shall change to a community-centered philosophy with resulting new demands on construction and adaptation of facilities and equipment.

The use of college play fields by adults will require that facilities be made ready for night use. Illumination of play areas will become a more common practice, because the evenings are ordinarily the only time for recreation for industrial workers. Furthermore, evenings are cooler in the summer and encourage students and adults alike to participate in physical activities. Provision for lighted play areas will be readily paid for by the increased patronage at sports contests held in the evenings.

With the return to "normalcy" in American life, improved transportation facilities will make possible the utilization of land on the outskirts of town for college and community-centered recreational areas. It is probable that many of our campuses now located in congested areas will be moved to new locations in less densely populated suburbs where more land will be available for play use. Facilities will have to be adequate to accommodate large groups of students and townspeople. This is equally true of indoor facilities.

As Engelhardt has so succinctly stated, the schools will tackle earnestly this job of building sound men and women as it never has in the past. "Small school sites and inadequate and inefficient recreational and body-building facilities will not be countenanced. Gymnasiums, note the plural, will be parts of the school plant. They will not be merely the inner tubes of auditoriums, but will be planned for all day and evening service in body building. Correctional gymnasiums will increase in number. New emphasis will be placed upon the use of the out-of-doors. School sites will be measured in real acres instead of square feet."[2] Certainly this recognition of the need for a sufficient school plant will not be confined to the public elementary or secondary schools. Colleges and universities must share in this national fitness program during and after the war, and their properties must be considered as community recreation resources.

Some Shortcomings of Physical Education Facilities

This preliminary discussion of wartime trends in physical education and their possible carry-over after the war gives many clues to the type of architecture that will be needed. For one thing, it is certain that the modern conception of the ideal physical education plant will be the outcome of cooperative planning by architects, college administrators, and directors of health and physical education. This cooperation has been lacking too often in the past, with the result that there are many facilities that are inadequate, poorly designed, and not flexible enough for needed additions or alterations. The physical educator will have to study his needs from the standpoint of facilities and then must be able to interpret these needs clearly to administrators and architects.

Changes in Lockers and Shower Rooms.—Much can be learned from previous mistakes in physical education building construction. For example, it has been the practice to locate the entrance to a shower room from the locker room in such a position as to require that students pass by large areas of steel casement windows to reach the showers. In spite of its excellent construction, this type of window permits cold air to enter. One possible remedy for this unfavorable condition is to place the entrance to the shower room in the middle of the locker room or away from the windows. Still another solution is to use hollow glass brick for wall construction; it not only provides excellent insulating material but, at the same time, permits the entrance of adequate light into the locker room.

While the use of exposed plumbing does not add to the beauty of locker, shower, and toilet rooms, experience has proved that concealed plumbing is impractical; the repair and replacement of pipes, traps, etc., being very costly. Furthermore, the tearing out of walls and the subsequent patch jobs that have had to be made where plumbing has had to be replaced is no less unsightly than exposed plumbing. Beautiful tile walls have been ruined by leaking, concealed pipes. Protected and exposed pipes placed in such a manner that they do not present a safety hazard seem to be the most satisfactory solution to this problem; or, as another possibility, runways can be provided behind the walls.

The prevention of athlete's foot has been the concern of physical education teachers for several years. The best method of prevention has been a moot question for some time. Foot baths containing a chlorine solution are widely employed. In some of the modern swimming pools, a permanent foot bath has been built in; this is usually placed in a depressed rectangle in the floor immediately adjoining the entrance to the pool. Built-in foot baths present a definite safety hazard, and from an aesthetic viewpoint are questionable. The chlorine solution in them precipitates rather rapidly with use and becomes unsightly if not changed frequently. More recently, a new preventive for athlete's foot is gaining in popularity: ". . . the danger of infecting feet on floors of swimming pool runways, locker rooms, and shower rooms can be materially lessened by the use of a new floor surfacing material. . . . The new material is called hubbelite and contains an important ingredient in cupric oxychloride. The flooring when wet releases a minute amount of the copper compound and thereby produces a powerfully destructive effect . . . on the microorganisms which produce 'athlete's foot.'"[3] The practical benefits of hubbelite are still to be proved with use, but it is hoped that this comparatively new discovery will aid in eliminating this troublesome problem. Preliminary experiments with the use of hubbelite have been conducted by Dr. W. L. Mallman of East Lansing, Michigan and have been reported in the September 1941 issue of the *Journal of the American Medical Association.*

Still another problem in connection with shower rooms and swimming pools is that of providing floor surfaces that do not become slippery when wet. Surfacing materials containing sand or pumice have been employed in some instances. Tile has been prepared

[2] N. L. Engelhardt, "The Impact of the War Upon School Building Planning." *The American School and University*, 1942. P. 15.

[3] E. D. Mitchell, "A New Hygienic Aid," *Journal of Health and Physical Education*, September 1941. P. 407.

similarly for use on the edges of pools. An entirely satisfactory surfacing is yet to be devised.

Field-House Problems.—Reference has already been made to the field house as a standard inclusion in the college physical education plant. The field house greatly increases the possible range of physical activities. At the same time, however, it does present unsolved problems in heating, ventilation, and lighting. The finest example of adequate and diffused lighting which the writer has seen in field houses is that at the recently constructed physical education building at the Michigan State College in East Lansing, Mich. Indirect lighting will be more widely used as the design and placement of this type of illumination are improved. Increased use of fluorescent lighting is also foreseen.

Heating and ventilation in field houses present a real problem, primarily because of the magnitude of these structures and the large number of windows and doors provided in them. The great window areas also produce glare, directing light into the eyes of participants at certain times of the day. Continued experimentation with glass brick as a construction and diffusing material may result in a satisfactory solution to this problem.

Lockers vs. Steel Baskets.—In the colleges the war has brought universal physical fitness requirements; that is, all physically able students must take part in the program instead of just the freshman class, as customary before. Experience has shown that with such an intensified physical fitness program in operation, the facilities for exercise are overtaxed, particularly the locker rooms. The number of lockers is now inadequate, and new ones cannot be purchased. The use of steel baskets for these enlarged physical education programs may be a more efficient administrative procedure from the viewpoint of the greatest possible use of space. This brings up the problem of distribution of baskets, which requires constant locker room help. Whether the advantage is with lockers or with wire baskets is still debatable.

Advantages of the Central Plant.—The centralization of the physical education plant is a very desirable procedure in planning and designing. Staff members and students lose considerable time in traveling between widely separated buildings and play fields. An opportunity to build staff morale is somewhat diminished when separate units are located at considerable distances from one another. Still another difficulty of the decentralized plant is the obstacle it presents to adequate supervision of staff and student activities. These factors, in addition to such considerations as heating, communication, and complete use of all facilities at all times, are improved or facilitated by the central plant.

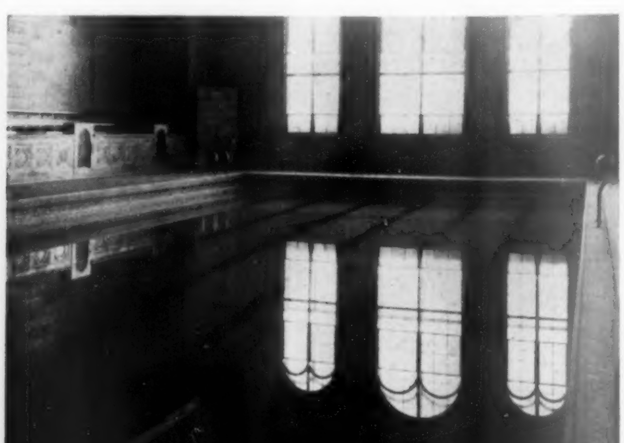
A few physical education plants in colleges are using spacious underground tunnels to connect their various units. The advantage of these tunnels during inclement weather, particularly in northern climates, is apparent. They have the additional value of helping to centralize the plant.

Internal Roof Structure.—The width of span in the internal structure of roofs of gymnasium and field houses has often limited the area and height of these facilities. New welding techniques will undoubtedly be developed to produce a lighter weight and more attractive structure and will make it possible to have maximum floor space and height in physical education buildings. The mass and reticulum of supporting girders will become obsolete. An example of the advantages of this new welding process may be seen in the new physical education building at Mississippi A. and M. College at Starkville, Mississippi. The standard procedure for constructing gymnasia has usually been to carry the wall up to a certain height, possibly twenty-five feet or more, and then to begin the standard engineering practice of cross members to support the roof. This has resulted many times in restricting the size of the floor space, on account of the span necessary, with the result that the building does not have the facilities for a wide variety of activities.[4]

Increasing the Uses of the Stadium.—More frequent use in the future will be made of our stadiums. The space under these structures has frequently been

[4] Information contained in a letter from Mr. A. S. Hotchkiss, Superintendent of Training and Community Service Bureau, Tennessee Coal, Iron and Railroad Company, Birmingham, Alabama.

This spacious pool at Ohio State University has a cork ceiling, tile walls, and electrically-controlled windows



Many records have been made in the swimming pool at the Intramural Sports Building, University of Michigan

The separate beginner's pool at Ohio State University has a maximum depth of 4 ft. 5 in.

Glass brick is used in the attractive swimming pool at the University of Washington

planned for mere support to the "stands." Some schools have employed the understructure of their stadiums to house students, or to house facilities for handball, squash, boxing, wrestling, "corrective" rooms, etc. The University of Wisconsin and the University of Minnesota, in particular, have made advantageous use of their stadiums in this manner.

The college gymnasium building has neglected in the past to provide special dressing quarters for its faculty members. It is surprising how well faculty members will turn out for exercise if facilities for recreative sports are provided; and they also appreciate the privacy and sociability that go with special locker and shower facilities for them. Faculty participation makes for informal faculty-student relationships and engenders a friendly attitude toward the physical education program.

Some Suggestions for Architectural Planning

The foregoing comments have dealt mainly with war trends that may become permanent, and with the shortcomings of traditional gymnasiums. In addition, here are a few more ideas that might well be kept in mind in architectural planning.

Aesthetic Design.—It is to be hoped that in the future new facilities for physical education will be in more harmonious accord with the architecture of other buildings on the campus. In spite of the exacting and special requirements of the physical education plant, it is not too much to expect that these structures should be beautifully and harmoniously designed. The impressive physical education buildings at the University of Texas exemplify this principle. The gymnasium, field house, or sports building can be of real beauty. While utilitarian value is of paramount importance, attractive exteriors and aesthetic interiors can still be designed with pragmatic value uppermost in the mind of the architect. Friezes of figures of sports, plaques, murals, and sculpture can add much to the "atmosphere" of physical education buildings. The Intramural Sports Building at the University of Michigan and the gymnasium at Yale University are also good examples of attention to aesthetic design.

Design for Flexibility.—The design of buildings will be adapted to expansion. The higher the building, the more the cost; greater height means elevators, more stairs, heavier and more durable construction, more fire-resistant material, etc. All of these structural details are costly, and lessen the opportunity for expansion that is found in the building of less height. It has been learned, too, that buildings of many floors discourage outdoor activity. Insofar as possible it is desirable that physical activities be carried on in the open during the greater portion of the year. Buildings of not more than two stories in height seem to be ideal from every standpoint; and the entire physical education plant should be built above the ground level with suitable exits placed for convenient entrances to play fields.

Design for Cleanliness.—Future planning will call for more adequate sanitary facilities—toilets, wash basements, urinals, built-in expectoration receptacles, showers—in proportion to use. More time will be given to planning the placement of these facilities in order that their location assures convenient or optimum use.

Drying rooms located properly in relation to shower rooms will become standard equipment for the physical education plant. Many schools now possessing them have learned from experience that they have great practical value, in spite of the fact that they are often placed inappropriately. Adequate and well-designed drying rooms for athletic equipment will also be a common consideration in the design of facilities.

Surfacing for Play Areas.—Proper drainage, suitable surfaces for a diversity of sports uses, erosion, and the allaying of dust are very common problems today and are still to be solved to the satisfaction of teachers and groundskeepers. Soil experts and engineers will be consulted for advice on the best kind of surfacing in specific geographic areas for the use to which these surfaces will be put.

Facilities for Instruction.—Colleges that include professional courses in physical education should plan to have some classrooms in their gymnasiums, sports buildings, or field houses. Classrooms are useful, too, for the regular student classes. Without doubt there will be an increasing amount of instruction in the theory and rules of various sports in the future, par-

ticularly with the visual aids that are becoming more and more easily available. Through movies students will be able to see the fine points of their favorite sports demonstrated by the "masters." This use of the motion picture will necessitate rooms designed for the projection of films. Radio and public address systems will likewise be installed for instructional and administrative purposes. A large assembly room will also prove its worth, since more and more each college is serving as host for clinics, rules meetings, and educational institutes for the schools in its surrounding territory.

Miscellaneous Features of Construction.—This discussion has not fully explored the possibility of such new features of building construction as fluorescent lighting, sound proof walls, and air conditioning. It is not too fantastic to surmise the invention of an extensive ultra-violet ray installation in the gymnasium proper by which a coat of tan may be produced just as though the participants were exercising outdoors in the sun. Nor, in the entire matter of building construction, can the possibilities of plastics be overlooked.

Considerable emphasis is being placed on running as a "physical conditioner" at the present time. It is likely that increased facilities for indoor running will be provided after the war. The use of portable banked turns (which may be conveniently recessed when not in use) may be the answer to this particular question.

Another practical problem for architects is that of planning spectator accommodations for handball and squash; also of making adjustable walls so that the handball court can be converted to use for squash and vice versa. As yet there has been no answer for these needs.

Conclusion

World conditions are changing so rapidly that nothing seems settled. But it seems certain that for some time after the war the present emphasis on physical fitness will continue uninterrupted, and it is not beyond the realm of possibility to consider that physical education will receive a curricular recognition on an equal basis with other subjects. This contingency, then, points to a need in the way of facilities that is far from being met. It is not improbable that government support will be forthcoming. Federal works programs of immense magnitude have already been forecast by the National Resources Planning Board. We can expect, too, great advances in constructional and maintenance materials and in inventions that will directly facilitate the future physical education programs.

So it is no time now to "forget" construction in physical education. Rather it is a time to plan—and to plan intelligently and cooperatively. We are all in accord with Engelhardt when he states that "The school housing of the future must be founded upon imaginative thinking and planning, with full consideration of the tremendous forces having impact today upon our civilization."

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MODERN METHODS OF OPERATING AND MAINTAINING SWIMMING POOLS

By FRANK J. McADAMS

Chief Engineer, Englewood High School, Chicago, Ill.

IN order to formulate the best method of maintaining and operating indoor swimming pools, consideration must be given to the proper design and location of the pool and its equipment. It is a known fact that many installations of pools and equipment are not giving full satisfaction for efficient operation and for the safety and comfort of the swimmers because of inadequate provisions at the time of construction; and it is very difficult to correct errors after the job is completed.

Efficiency in the Original Design

There are nine prime factors to be considered in the original design of the swimming pool and its equipment if the best methods of maintenance and operation are to be made possible of achievement. These factors, therefore, are basic.

1. ***Location of Pool and Its Environs.***—Swimming pools in general use in high schools and universities are rectangular in shape and of two generally accepted dimensions: 24 by 60 ft. and 40 by 75 ft., with 6-ft. lanes and a maximum depth of 8 ft. The smaller pool, with a water capacity of about 60,000 gallons, meets all the needs of a secondary or high school. Such a pool will accommodate 30 to 35 pupils in each class. It is perhaps the most common in use, costing less to install and service, although the larger pool is preferred in competitive aquatics where two-meter boards are used in diving contests.

The pool should be elevated to such an extent that the bottom foundation is at least on a level with basement floors, leaving the exterior walls exposed in the equipment room below. This will make possible a drainage grade for emptying the pool.

The floors and sidewalls of the pool should be surfaced with enamel brick set in white cement, with a black or green course outlining the lanes for swimmers. The smooth enamel surface is a great factor in cleanliness and leaves no rough surface for the formation of algae. Sufficient head room above the floor of the room is highly recommended—20 ft., if possible, to permit proper ventilation.

The adjoining shower or locker rooms of the pool, straddle shower, and foot bath should be placed adjacent to the pool and readily accessible to it. Separate shower and locker facilities for males and females must be provided. Due consideration must be given to the difference in construction of the separate units for each sex.

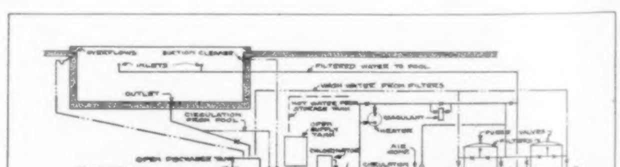
2. ***Recirculation Systems, Open and Closed.***—The old system of "draw and fill," with its costly waste of water and of heat dissipated through the overflows, has long since been discarded. The accepted method entails recirculation of the water drawn from the outlet. This water is carried through filters, sterilized, and returned to the pool. There are two methods of recirculation now in use—the "open" and "closed" systems.

The open system provides for the waste to be carried through the overflow or scum gutter to the sewer. This requires a constant feed of make-up water to replace the water dissipated through the overflow.

With a closed system the overflow water goes to the filters for sterilization and returns to the pool with the circulating water. Though this system adds to the original cost of the investment, it constitutes a marked saving in the cost of make-up water and of heat which would otherwise be lost with the overflow water. Another advantage of the closed system is the constant and uniform level maintained in the pool at all times, an important factor when the pool is used for competitive athletic feats.

All pools should be designed with a recirculating equipment capable of circulating the complete contents of the pool once in six hours. This is an accepted present-day practice.

The accompanying diagrammatic plan shows clearly the elevation of a modern swimming pool. It illustrates the Chicago open system of recirculation designed by John Howatt, chief engineer of the Board of Education. The raised perimeter of the pool prevents floor splash from entering the pool and provides proper floor drainage. The overflow or scum gutters are inside this elevated perimeter. During the construction



Elevation drawing of a swimming pool, illustrating the Chicago method of recirculating water. This plan could be applied to pools of any size by increasing or decreasing the capacity of the equipment

of the pool care should be taken to set the overflow at gutter level, so that the water flows over evenly all around the perimeter.

Two surge tanks are provided, one to prevent back-flow of sewerage water under flood conditions, and one to prevent back-syphoning of pool water into the house service in the event of failure of water pressure. This is a precaution required by most municipalities.

Five-point circulation with four inlets, two at each end, utilizing the outlet as a pump suction, are shown on this plan. The overflow is connected to the open tank, which opens into the street sewer. The open supply tank maintains sanitary standards for positive break in the sewer connection. The sterilizing agent is connected to the suction of the circulating pump so that the filter quartz receives the full benefit of the sterilizing agent. The heater is shown with a bypass connection.

Most heaters installed are too large and permit too great a rise in the temperature of the water entering the pool. A small heater of about 12 sq. ft. of copper tube surface will be sufficient for a rise of 10° F. in a 60,000-gallon tank. This slow increase in temperature requires a longer period of time to raise the pool temperature on a complete refill, but it is preferable to a quick temperature rise.

While no dimensions are given on the plan, this design could be applied to pools of any size by increasing or decreasing the capacity of the equipment.

3. Water Sterilization.—The water in the pool must be cleaner and purer than the water used for drinking purposes. The tender membranes of the mouth, nose, eyes, and ears are all exposed to any impurities that may exist in the water.

Water sterilization is accomplished by several methods, each of which seems to have its own champions. The chlorine method is most generally used and is perhaps the easiest to control. Two general types of the chemical are used—pure chlorine gas and sodium hypochlorite.

Chlorine gas is delivered in tanks and fed directly into the pool through a pulsating device controlled manually according to the need of the pool. While this method is the simplest and serves fairly well as a germicidal agent, there are serious objections to its use. First, it requires the addition of a base to the water in order to neutralize the acid reaction of the free chlorine, which causes smarting of the eyes and the membranes when the chlorine content reaches .7 or .8 parts per million. Second, the gas may escape from the room containing the machine for injecting the chlorine gas into the water. This room should be sealed from the main building and should have a positive vent to the atmosphere. Failure to take this precaution will involve the life of everyone within range of escaping gas.

Sodium hypochlorite is produced by the passage of a low current of electricity through a solution of common salt in water; this produces pure chlorine gas and caustic soda. The chlorine and caustic mix with the water to produce an efficient and active sterilizer. The excess caustic soda preserves the normal alkalinity of the water, preventing formation of the hypochlorous acid that causes smarting of the eyes and irritation of the mucous membranes.

Great stress should be laid upon the need for an alkaline condition in the pool. It is a known fact that disease germs in this temperate zone propagate readily in an acid condition, while an alkali, though not a positive germicide, is very effective in restricting their activity.

There are other means of sterilization, such as the use of ozone, the cost of which, however, is prohibitive in most installations. Another method sterilizes the recirculating water by exposing it to ultraviolet rays. This system is not in general use, perhaps because of the fact that bacteria may be carried through by the turbulence of the water or by the adherence of the bacteria to some foreign substance that may enter the pool through faulty filtration.

4. Toilet Facilities and Locker-Room Equipment.—Toilet facilities of adequate capacity should be placed adjacent to the locker rooms. The locker-room equipment should include group lockers, wide aisles, and benches for the accommodation of the swimmers. The floors of the locker room should be smooth and of a non-skid type, with good pitch for drainage.

5. Showers, Foot baths, and Inspection of Bathers.—Shower facilities and foot baths are necessary equipment for the cleanliness and safety of the swimmers, all of whom must bathe in the nude before entering the pool. Showers controlled by a timed push-button valve leave the bather's hands free so that he can use both hands for soaping. Straddle showers are used to some extent, but are not as yet considered a necessity. Provision should be made for a foot bath in which the swimmer must stand before entering the floor surrounding the pool.

The need for physical inspection of every bather should be emphasized. The physical instructor should make a thorough inspection of all swimmers after showers, before they are allowed access to the pool. This should be done according to rigid rules or standards set up by the physical director. Assistance from this source will materially ease the load on the operating equipment.

6. Ventilation and Temperature.—The ventilation of the room in which the pool is located should be based on cubic feet per minute (C.F.M.) per square foot of floor area, and not on the cubic contents or changes of air per hour. The Chicago code disregards the actual area of the pool and uses only the floor area and number of spectators' seats in its computations. The code requires 20 C.F.M. for each spectator seat, plus .8 C.F.M. per square foot of floor area and 2 C.F.M. per square foot for open spectator spaces with no fixed seats. Motor-driven inlet and exhaust fans are essential to proper distribution of the air.

The temperature of the room should be 78° F.; that of the water should be 74° F. When the temperature of the room is above 78°, inlet air may be admitted near floor level and exhausted at the rear of spectators' area. Care must be taken to prevent the existence of dead-air pockets at remote sections of the room. The shower and locker rooms, where no windows are used for ventilation, should have a positive exhaust of 1.2 C.F.M. per square foot of floor area. Inlet air must be provided, but its volume is not specified in the Chicago code.

7. Illumination.—Lighting is an important factor in any swimming pool. All lighting units must be placed in readily accessible positions. The bottom of the pool should be clearly defined. The general illumination should be evenly distributed, with the

object of protecting the eyes of both spectators and swimmers from glare. If underwater units are installed in the side walls of the pool, they must be flush with the walls for safety, and readily accessible from the outside walls of the pool. Illumination is an essential factor in the prevention of accidents, and adds to the attractiveness of the pool.

8. Floor Construction and Drainage.—The floor surrounding the pool should be of a non-skid type, preferably tile. This is an essential feature in the prevention of accidents. Proper floor pitch should be provided for quick drainage. The drains should be placed at close intervals and be of sufficient capacity readily to remove the water splashed over from the pool. The appearance of the pool itself may be seriously affected by a surrounding floor with improper drainage, and might easily become a source of danger by collecting infectious water that can be carried back into the pool. Improper drainage can seriously impair the effectiveness of pool sterilization.

9. Spectators' Section.—In all swimming pools, competitions are considered a part of the pool activities. It therefore becomes necessary to build a spectators' section. This is usually constructed on a raised level, with seats stepped back to give each spectator an uninterrupted view of the full length of the pool. This section must, of course, be isolated from the section used by the swimmers. Separate entrances should be provided for the spectators.

Efficiency in Operation and Maintenance

Responsibility of Operating Force.—The burden of protecting the public from the menace of contamination falls squarely upon the shoulders of the operating force, for a major epidemic may spread with startling rapidity once a pool becomes polluted. The human body may retain germs for two or even three weeks before disease develops. With several hundred swimmers using the pool daily one can readily see that several thousand individuals could be exposed to disease before the first case came to medical attention. The operating force, therefore, should be thoroughly trained in the technique of efficient pool maintenance.

There is great necessity for keeping daily records of the operation of the pool. Each day's record should include data regarding circulation through the filters in gallons per minute, chlorine contents (three daily readings), temperatures, differential pressure of the filters and sex of the swimmers. A clear pool does not always indicate a safe pool, so be governed by the readings on the record chart.

This record makes the maintenance crew conscious of the importance of uniformly high standards, and forms a ready reference for any one interested in the operation of the pool. It also forms a basis for defense should the charge of neglect be directed at the operators.

Physical Condition of the Water.—A turbid, cloudy appearance may be given to the water by colloidal activity. Colloids, visible only through the ultra-microscope, are insoluble particles suspended in the water. Most colloids, being metallic salts, are of like polarity and repellant to each other. A dancing motion results which is known as the Brownian Movement.

Colloids may be broken down by the addition of mild acids or alkalis, such as alum; in other words, by the introduction of an electrolyte with the resulting decomposition of the compound by electric current. By this breaking-down process polarity neutralization occurs and permits the particles to coagulate and be retained in the filter.

If alum is used it sometimes escapes from the filter and gives a milky appearance to the water. Care must be taken, therefore, to keep the alum in the filter where it belongs.

If the same water is recirculated over a long period of time without being emptied from the pool, algae may form on the side walls, ladders, and floors. This greenish seaweed ranges in size from a one-celled organism to a very long and stringy plant, and propagates in an acid condition. To remove this fungus growth, the pool must be emptied and the walls and floor thoroughly cleaned with a dilute solution of copper sulphate. Care must be taken to prevent the copper sulphate from attacking the cement in which the glazed brick is laid. If the solution is brushed on the affected parts and immediately washed off with a stream of water, the brickwork will not be damaged.

If a relatively high chlorine content is continually maintained in the pool the algae will not form, and complete cleansing with copper sulphate solution will be unnecessary.

For the removal of solid matter all modern pools are equipped with a manually operated suction cleaner which is connected to a portable suction pump or to a suction connection to the circulating pump. This is a very effective means of cleaning the floor of the average indoor pool which is in daily operation. The weekly use of the suction sweeper should be sufficient to keep the pool clean.

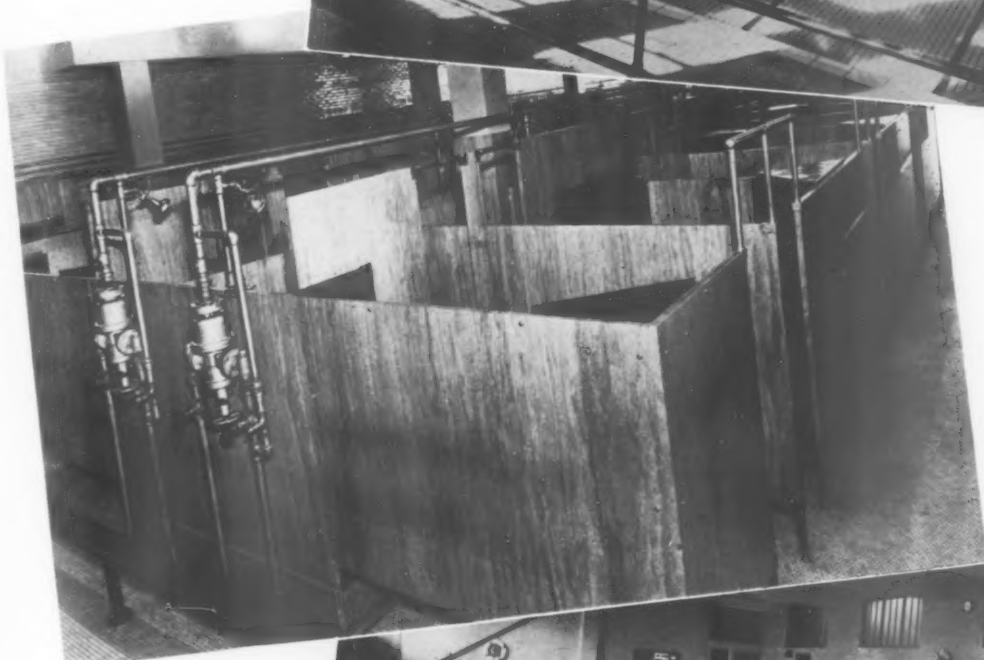
Chemical Condition of the Water.—Ortho-Tolodin readings should be made at least three times daily when pool is operated at full capacity, and a careful record kept of all readings. This record will protect the operator from blame should a sudden epidemic appear.

The neutral point on the pH scale being 7, a reading above this point denotes alkalinity, while a reading below indicates an acid condition. With a pH reading of from 7.2 to 7.4, a chlorine content as high as 1 part per million causes no noticeable irritation in the swimmers' eyes or membranes. But if the water is below 7 on the pH scale, chlorine content should be kept between .3 and .6 PPM and immediate steps taken to raise the alkalinity. When the chlorine content drops below .2 PPM, take emergency steps to remedy this condition and forbid use of the pool until it is safe.

Foot Baths.—In order to prevent skin troubles caused by fungus, provision must be made for some form of foot bath for the swimmers' use before they are permitted in the pool. Water with a solution of sodium hypochlorite, of a chlorine content not less than ½ of 1 % and preferably 1%, must be kept in this bath. The high percentage is desirable because of frequent dilution by water dripped from bathers and by loss due to splashing. When commercial sodium hypochlorite of 14% solution is used, a dilution of 1 to 14 will give a chlorine residual of 1%. The time a bather stands in this solution is also important.

The foot bath solution should be changed according to pupil load. Where the load is about 400 on a

Pool, 40' by 75', with spectators' section in the background, in the Calumet High School, Chicago, Ill.



A girls' shower and locker room, with individual accommodations and master mixer controls

South Shore High School pool in Chicago, 24' by 60', is a typical medium-sized high-school pool

10-hour basis, the solution should be changed twice daily. When regularly and intelligently used, the foot bath is an effective medium of prevention and a decisive aid in the cure of the fungus growth.

Sterilizing the Floors.—Tile floors, because of their porousness, are subject to water marks and are a great source of trouble. Constant attention is required to maintain them in a sanitary and attractive condition. A combination of soap and body grease lodges on the surface and in the cracks.

In the sterilization of the floor surrounding the shower and locker rooms, strict attention must be given to an effective sterilizing agent used as a means of destroying any fungus growth that may be carried on the feet of the swimmers. This should be faithfully done at least once a day. A practical means of floor sterilization is mopping with a water containing a solution of sodium hypochlorite of a strength of at least 1%. The sodium hypochlorite solution used on the floor should be left wet and permitted to dry on the surface. Any effort to dry-mop would destroy the effectiveness of the sterilizing agent.

Sterilizing Swimming Suits.—Swimming suits are usually worn only by girl swimmers. They are generally of the cotton type known as tank suits and should by all means be sterilized at the end of their use before being dried and stored for wearing again. There are two generally used methods of sterilizing the swimming suits. The first is by immersion in a solution containing high sterilizing agents. This is rather a hit-or-miss means; for while it may be resorted to as quicker than the second method, it is open to criticism because of incomplete sterilization in the seams or hems.

Another system of sterilization which is far more acceptable and effective is sterilization by steam. In this a steam sterilizer is used similar to that used in hospitals in which low pressure steam of approximately 15 pounds per square inch is maintained for a period of 15 minutes. Here the high temperature and the length of time of contact spells death to virulent bacteria that may be carried from the body of the swimmer. The suits are placed in a basket of sufficient size to carry the suits of one swimming class. After the period of exposure to the steam in the sterilizer, the suits are removed and placed in a hot air dryer before being stored for future use.

Maintaining Efficient Filter Operation.—The rate of filtration is usually at three gallons per square foot of cross sectional area of the filter. This low rate give a relatively slow motion of the water in the filter bed, and with keen attention to backwashing excellent results are secured in operating the pool.

A flow meter on the discharge pipe of the circulating pump, or on the inlet pipe leading to the manifold, should be used to indicate the rate of filtration in gallons per minute. This indicator consists of two columns of mercury and shows a differential pressure between two sides of the meter orifice in the pipe. This orifice is calibrated, and the difference in levels of the mercury columns indicates on a scale the rate of flow in gallons per minute. It is advisable to record this information on the daily operation chart.

As the filter is used, the air trapped in the upper section of the filters will gradually collect until it is a serious menace to the operation. This air must be removed, as it prevents an even distribution of the filtrate over the full area of the filter bed and may cause channelling through the quartz, impairing the efficiency of the filter. The air should be bled out of the top, either by hand or by an automatic float trap.

Alum is used as a coagulating agent only, and has no other value. It is introduced into the water before it enters the filter by the simple means of by-passing a small flow of water through the alum pot. In feeding alum into the filters it is well to watch the flocculence which is indicated by the increase in differential pressure. Alum will not floc if subjected to an acid condition. Addition of soda ash in a soluble solution to the alum in the pot will immediately cure this condition. A second alum pot is often installed for the feeding of soda ash. Alum is used only as an added feature to filtration and should be maintained on the surface of the quartz and nowhere else.

Backwashing the Filters.—Watch the differential pressure of filters, which denote the frequency of need for backwash. In the backwashing of filters the best results are obtained by using a volume of water of four times the rate of filtration in order fully to remove the residue of the filtrate, not only that forming on the top surface of the filter, but also that which penetrates and lodges in the body of the quartz. In most cases such a large volume of water is not available, and the circulating pump is of insufficient capacity to deliver this needed amount. A very good substitute for this method is the introduction into the intake manifold of a volume of air of sufficient pressure to overcome the pressure within the manifold. This causes a violent agitation within the filter, similar to that which can be seen in an artesian well. This agitation has the effect of scrubbing the quartz and thoroughly cleansing it. We have found value in first backwashing the filter with water until the sight glass shows clear, then introducing air pressure into the manifold and agitating the backwash. The sight glass showed considerable dirt still being removed.

The usual time necessary to backwash is about fifteen minutes, while with the injection of air into the backwash water, the time has been reduced to five minutes. This operation alone saves fifteen hundred gallons of water; and where water must be purchased and heated, this factor in itself is worthy of consideration and would soon offset the cost of the small compressor necessary to accomplish these results.

Conclusion.—There is no substitute for health. This is God's gift to us to guard and cherish at all times. It is our effort in present-day swimming pool practice to provide sterile water, good ventilation, and cleanliness in the shower and locker rooms, as a contribution toward the health and safety of the swimmers.

The responsibility for instruction should rest with one person; and one person only should be responsible for the operators' duties. Division of responsibility creates confusion and lack of unity. Close cooperation between the teaching and operating forces is essential for effective pool operation and maintenance.

NEW PHYSICAL FITNESS PROGRAMS DEMAND NEW SECONDARY SCHOOL FACILITIES

By JAY B. NASH

Professor of Education, New York University; President American Association for Health, Physical Education and Recreation

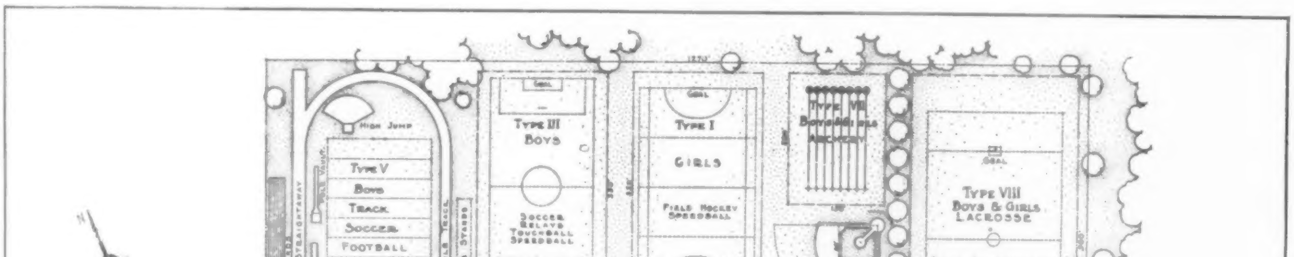
EDUCATIONAL programs, like automobiles, run relatively smoothly on the level or downhill; but the "knocks" show up on the steep grades. We struck a steep grade in 1941; and our programs of developing physical fitness must be revised to meet the new conditions.

Why We Need a New Program

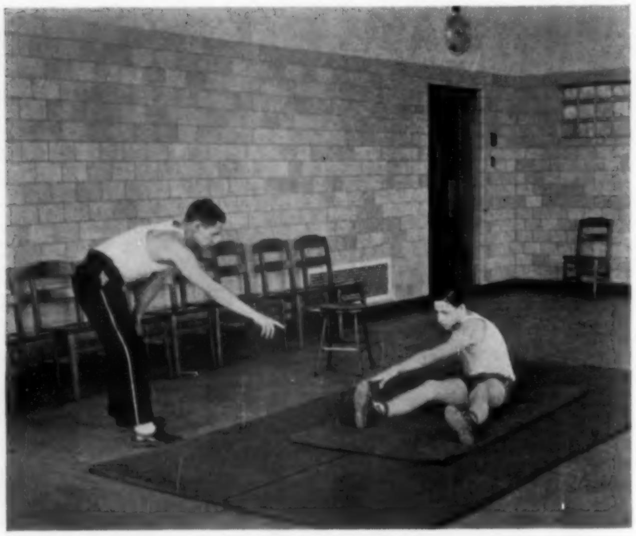
We are facing a nation in the East which has been preparing for war for a generation. All available finances and leadership have been utilized to direct the young men and women toward this contest. All techniques have been used to develop men with strength, agility, endurance, and enthusiasm. The one secret weapon, psychology, has been used to develop a nation with "wings and fire."

We are facing a nation in the West which has been in training for fifty years. Systematic training of youth has been applied with a vigor and a universality unknown in modern history. Muscular strength, cat-like agility, and endurance to hardship have been developed and utilized with almost unimaginable effectiveness. Systematic preaching of hate and revenge, and widespread assassination of peace advocators on the home front, have developed a psychological drive which makes formidable foes.

Our own nation, however, allowed itself to become vulnerable at a number of crucial points. People be-



Plan worked out in cooperation with the New York State Public High School Athletic Association. The physical-fitness program calls for a much wider use of outdoor facilities



came over-confident on the false premise that anything could be bought and bought quickly: organic power, the mechanisms of defense, and even the democratic spirit. As Chesterton intimated in his *Everlasting Man,* we had become a tired democracy where the citizens were less inclined to eternal vigilance than to arm a single individual to watch the city while they slept.

National Weaknesses and Needs

At the present moment we are not so much interested in those who have been rejected for military service as we are in those who are already in the armed forces. In the long run, of course, society must give some attention to the cause of rejection. Proper medical care, adequate immunization, and health guidance could have prevented many of these rejections. This is particularly true of teeth conditions, which are partly, if not largely, the result of diet.

For the purposes of this article, it is important to note the physical condition of those who have been accepted for the armed forces, both enlisted men and officers. Numerous weaknesses which almost might be called national weaknesses have shown up. These center around the following:

(1) *Upper arm and shoulder girdle strength.* Our physical education program, particularly our athletic programs, apparently have not provided adequate power-building exercise for these muscles. These are the muscles which pitched hay, lifted loads, chopped wood, and carried on many acts of pioneer life. The inability of many young men to chin themselves three times, or even once, is alarming. Army life requires, from the standpoint of daily use and of self-preservation, that we strengthen these muscles.

(2) *Abdominal strength.* Strength in the abdominal muscles is needed not only for the soldier's posture but for many acts which are necessary for our fighting men on the ground, in the plane, and in the tank. These muscles have not been adequately strengthened in many of our programs.

(3) *Endurance.* Some of the branches of the armed forces like to call this stamina; others call it heart power. Its rating is at a lower ebb than we had suspected. There have been entirely too much automobile riding, "climbing stairs" in escalators and elevators, and sitting in bleachers. This type of power is built when the heart is taxed slightly, but not too far beyond its norm. It comes from running, overhill jogging, swimming, and various other activities where the total body is in action to such an extent that heart power is demanded.

There is also a definite recognition of the need for teamwork and for opportunities of building morale. This has been recognized even by the Germans, who had been used to a formalized calisthenic program. As a part of their military training they have been offering soccer, basketball, hockey, lacrosse, water polo, and many other activities which in this country we call team sports. In the United States the need for team sports is emphasized in technical manuals issued by the War Department and the Bureau of Aeronautics of the Navy Department.*

Laws for a New Program

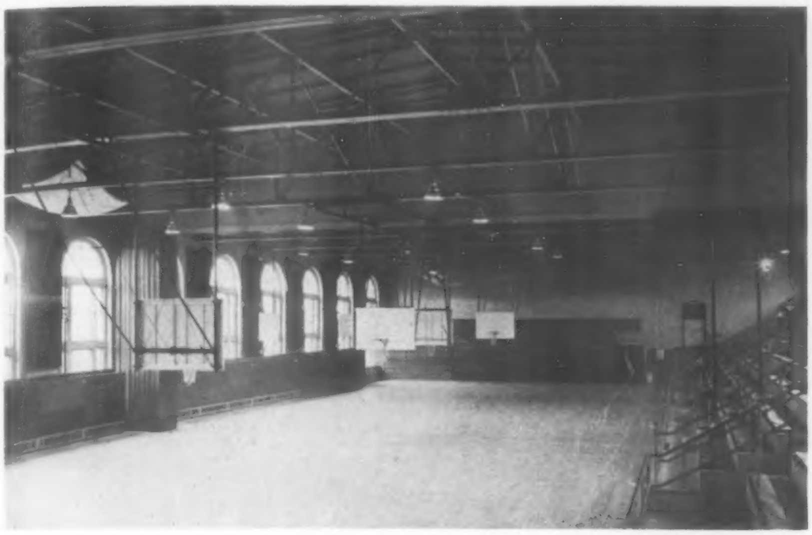
The direction of the new program of physical education, which emphasizes the need for new facilities and equipment, might be considered in the light of a number of principles which we will refer to as laws:

(1) *The law of use.* We acquire power through the process of doing: that is, individuals must be active. Practically anyone capable of being in school should have some exercise

* *Sports and Games,* May 13, 1942, Technical Manual, War Department.
Physical Fitness Program for High Schools and College, U. S. Navy Training Division, Bureau of Aeronautics, 1942.

Above—Room for individual activities in Junior High School No. 2, Trenton, N. J. There should be appropriate facilities for everyone in school

Right—A well-planned swimming pool. Note clearly marked lines and movable bulkheads



Left—Gymnasium floor, with maximum playing area and minimum area for spectators, illustrates the principle that the largest possible amount of space should be devoted to playing space

Below—Boys' shower room, Junior High School No. 2, Trenton, N. J. Disinfectant unit and towel basket have been conveniently placed

adapted to his needs. These activities will in turn require appropriate facilities.

(2) *The law of reach.* Individuals should be taxed to their capacity, particularly during their high-school years. In other words, a little more should be tried today than yesterday. Each program must be adapted to specific needs, and therefore the physical facilities should be adjustable. For instance, standard ceiling fittings should be such that apparatus is interchangeable.

(3) *The law of time.* Longer periods of time must be devoted to physical exercise if organic power is to be built. In order not to overtax present physical education facilities, program schedules should be overlapping. This would involve overlapping of instructors as well—some starting in the morning at eight o'clock, others at ten, at twelve, even at two and four. The last group would probably run through until ten o'clock at night. A twenty-four hour use of facilities would not be unusual. Many members of our armed forces consider twelve to eighteen hours of physical activity a week all too little to put men into condition. Counting the instructional period and the supplementary periods, the high schools should not drop below eight to ten hours of activity per pupil per week. To get this time in, facilities must be used over week-ends and over vacation periods.

(4) *The law of diminishing returns.* Every year after the age of fifteen, power-building activities are less effective. High-school years represent almost the last unit where universal training can be given with profit. It is not without significance that the armed forces want young men.

(5) *The law of rhythm.* The sustained efforts which carry people to the point of exhaustion must be avoided. Activities must be of the "go-stop, go-stop" type; the "walk-job" of the cross-country activities. Periods of intense activities balanced by short let-downs, as in team sports, represent a rhythm that is necessary. All activities should be encouraged that can be approached from the recreation viewpoint, where the individual enters with interest and emerges with exuberance.

Adaptation of Indoor and Outdoor Facilities

The general program would center around what may be called the "unit idea." Units of indoor and outdoor facilities should be available at odd times—early mornings, late afternoons, evenings, week-ends, and vacations. They should be so planned that other school-building units are not involved. Specific hints elaborating on the unit idea come under three general headings:

(1) *Administrative areas.* Offices should be so located that they are easily accessible to the various units without exposing the whole building to misuse. Health examination rooms, nurses' offices, and testing areas should be situated where they will be accessible at all times. Storerooms, equipment closets, washrooms, lavoratories, and locker facilities should be available for outside as well as for indoor units.

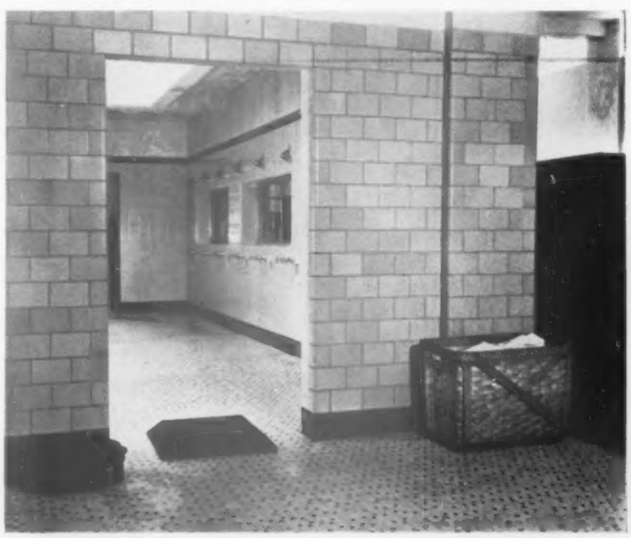
(2) *Service areas.* All service areas should be thought of in terms of caring for indoor and outdoor activity groups. Self-service baskets should be supplied in large numbers, so that lockers are occupied only while classes are in progress. This frees locker and shower-room facilities for all types of school and community use, and makes it possible for intensive additional use over week-ends, vacations, and holidays. Hot water, showers, towels, and lockers should be available in units which will not involve the other school units in the building.

(3) *Activity areas.*

(*a*) *Indoor facilities.* The largest possible amount of indoor space should be devoted to playing space, and the smallest possible amount to spectators. A separate building would fit into the unit concept. Supplementary rooms for boxing, wrestling, fencing, and for activities for those who cannot take the regular program, should be arranged on the unit plan. Swimming pools should be a separate unit and so located as to use the shower and locker facilities without complicating the administration of the entire building.

(*b*) *Outdoor facilities.* A much wider use of outdoor facilities must be considered. This will include not only the facilities under the jurisdiction of the school, but areas available in public playgrounds, parks, vacant lots, and even the trails over hills and valleys in open country, for the Com-

Photos courtesy of Walter Short, Board of Education, Trenton, N. J.



Agility can be developed

Upper arm and shoulder girdle muscles are developed

Over obstacles—a good strength builder

The old hitching post put to modern use

Photos courtesy J. W. Steinhilber, Hackensack High School, Hackensack, N. J.

mando-Ranger type of program is going to assume a significant place in physical education.

On the school grounds, more attention must be given to the surfacing of the areas. Part of the school grounds should have a hard surface. Such areas should be used intensively, except in the most inclement weather. The rest of the school yard should be of the sand, loam, or turf type, with good subdrainage. These areas should be carefully maintained.

Making the Most of Our Natural Resources

In order to train all the secondary high-school boys needed by the country, every available square foot of space must be used. Snow and rain must not be allowed to interfere with outdoor activities. If proper clothes-drying facilities are provided, and individuals have an opportunity for a warm shower and a vigorous rub-down, outside weather conditions offer no handicap to vigorous programs.

The keynote which the armed forces have given us is, "improvisation." Priorities will cut down our future supply of equipment containing steel and rubber. We must use imagination and initiative. Use of other resources—fences, hedges, and stone walls; climbing over ledges, running, dodging around trees and natural obstacles—all of these will have to be utilized to train a group of men who will give us the quality of fitness necessary for victory.

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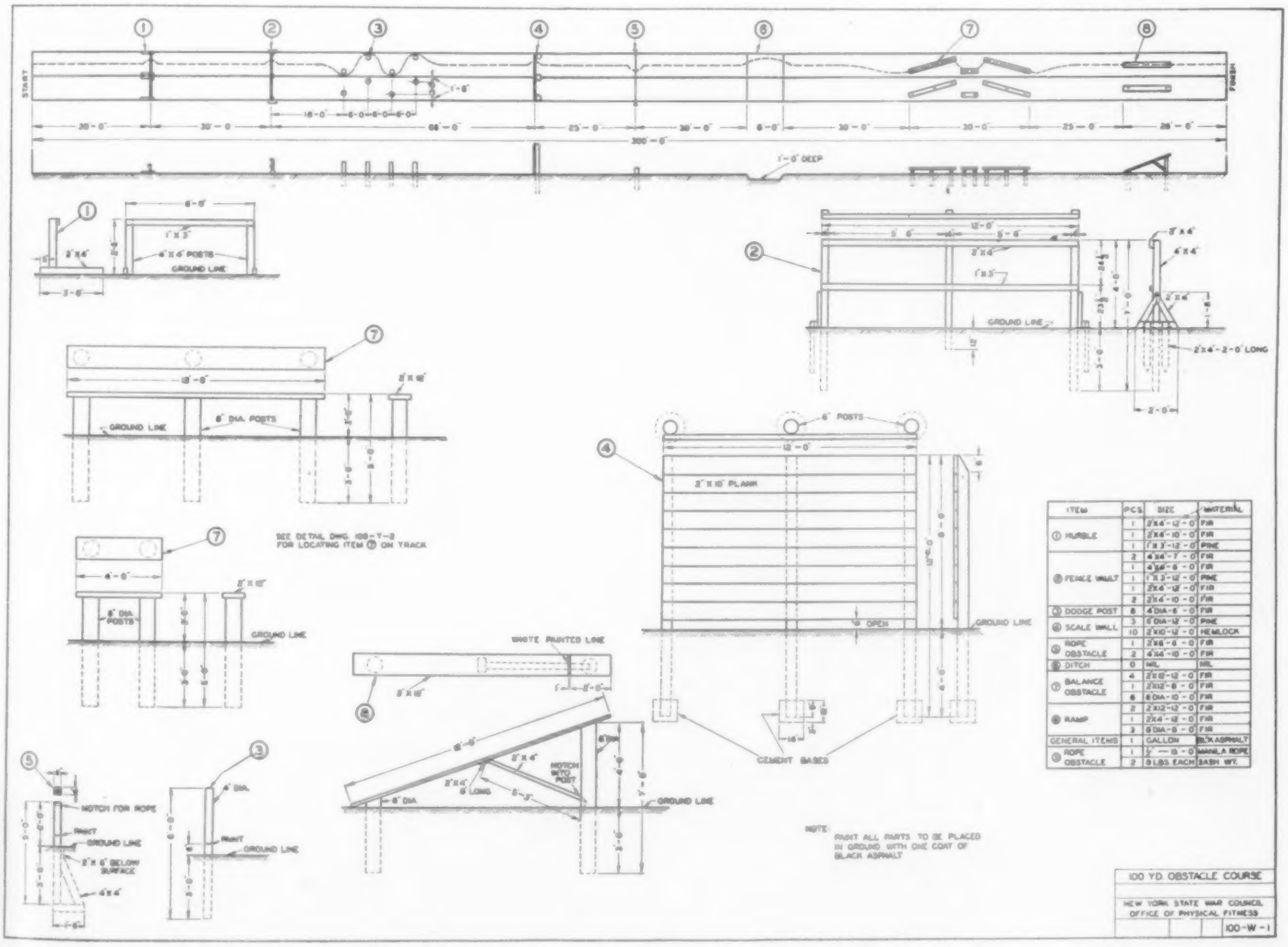
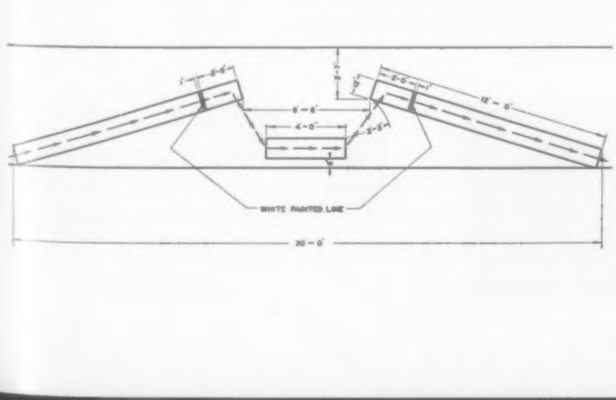
Physical Fitness Manual for Colleges and Universities, U. S. Office of Education, 1943. 109 pp. $.25.

Health Teaching Manual for Schools, U. S. Office of Education, 1943. 97 pp. $.25.





Detail drawing 100-T-2 for item 7 on the obstacle course is shown at left. A memorandum accompanying these specifications says: "The obstacle course is relatively easy to set up. All obstacles may be of reconditioned wood with the exception of the rope obstacle." Proper training is necessary to avoid injury to participants and for the development of maximum proficiency

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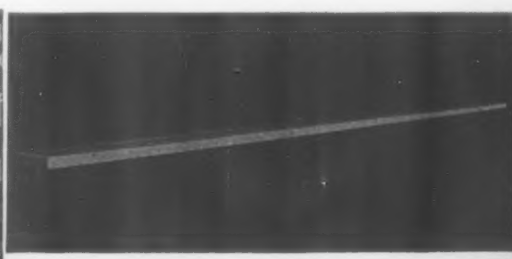

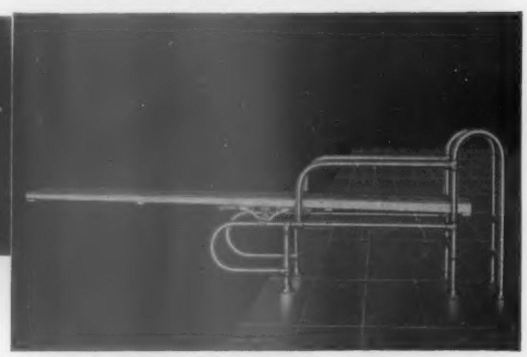

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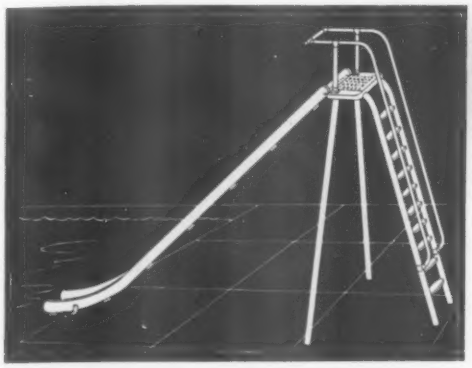

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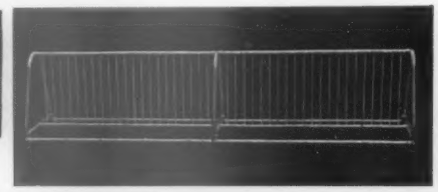

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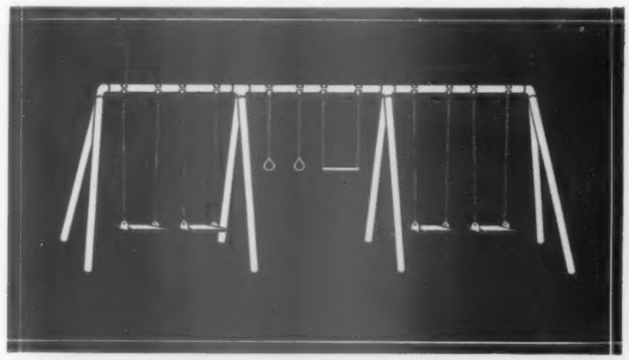

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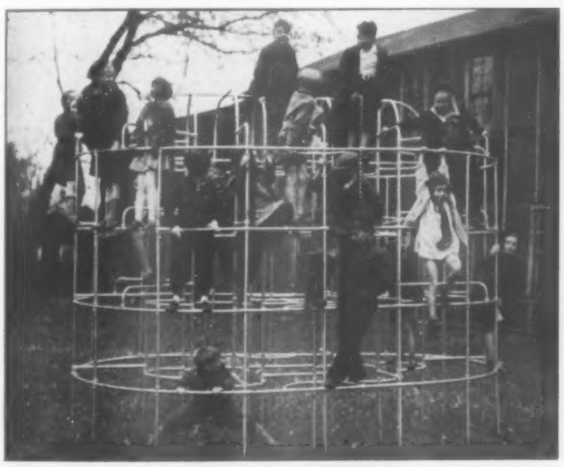

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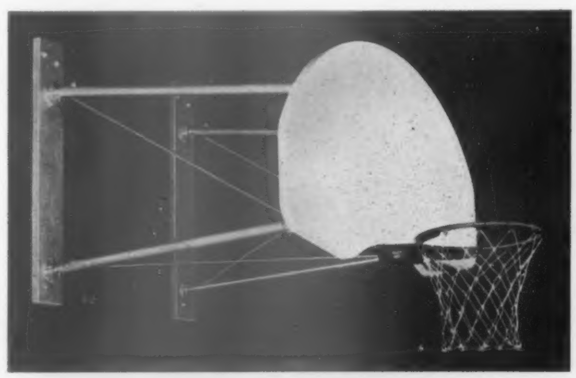

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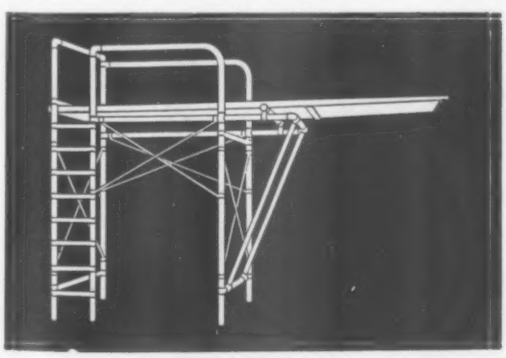

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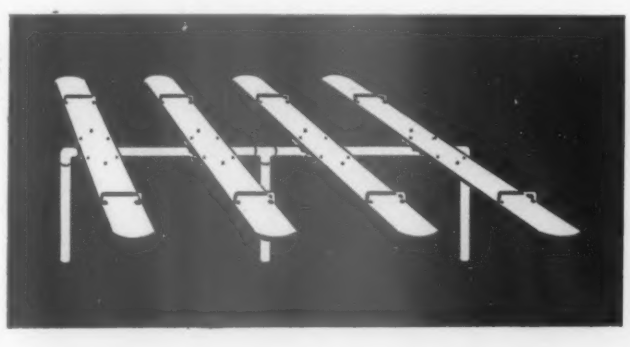

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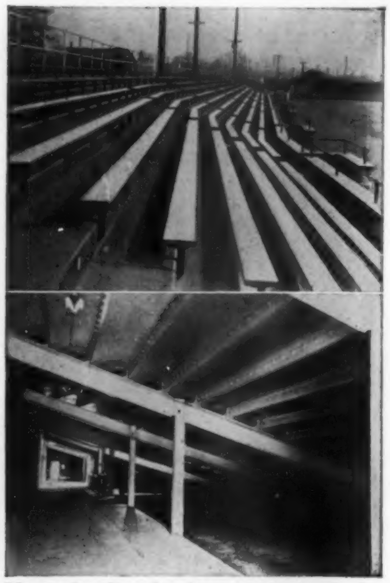

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SECTION VI
CLASSROOM—ADMINISTRATIVE OFFICE

CHILDREN'S CENTERS AND THE FUTURE

By JOHN E. NICHOLS

Supervisor of School Buildings and Plans, State Department of Education, Hartford, Conn.

OUT of the vast horror and waste of this war we may hope that here and there some good things, seemingly of little consequence by comparison, will be born. If we have the vision and the determination, the wounds that are now being inflicted upon the minds and bodies of little children everywhere may be atoned for in part. Out of a program that has been established to meet the emergencies of survival, we may build one which will go far toward helping children grow into healthy, happy, and wholesome youth.

With but few exceptions those responsible for public education in America, whether professional or non-professional, have evaded any open recognition of and responsibility for the developmental needs of children below that age when they are admitted to our elementary schools and kindergartens. A child's earliest years are by far the most important in shaping those characteristics which will fit or unfit him for a well-adjusted life. We have known this well enough. Yet for all our talk of "education for life," we educators have kept hands off until our subjects have thoroughly jelled for good or ill. Then with high resolve and great fanfare we have bent our efforts to applying much the same gloss of academic skills and knowledge to all, with little regard for the forms they have assumed. That through our neglect, and through individual ignorance and public apathy, the potentialities of many for realizing the goal of a well-adjusted life have been impaired, has been apparently a matter of only casual interest.

Private Nursery School Program Not Enough

What has been done for children below five years of age generally has been accomplished outside the sphere of public education. Much excellent work has resulted, and valuable information and techniques have come from the efforts of private individuals and institutions. But, by the same token, much poor work and even harm have been done by dear ladies whose principal qualifications have been an over-developed maternal instinct, the possession of an unoccupied room, and a desire for pin-money.

But the group that has thus been served has been a selected one. It has included only those fortunate children whose parents occupy the upper economic strata. The great majority of children, including those most in need of a good nursery school program because of unfortunate family relationships or unwholesome living conditions, has been denied it, except occasionally on a charity basis. The ironical aspect of the W.P.A. nursery school program is that it was not originated to care for children primarily, but to provide relief jobs for adults.

Public Nursery Programs Unsatisfactory

Now at last the door of public education has been opened to the nursery school—just a little, cautiously and timidly in response to the clamorous knocking of industry and the god of war. Not the front door, but the back—unlocked by federal money made available through the Lanham Act. Once more the child is being exploited so that adults may work; nursery groups are springing up all over our nation because war industry needs mothers to help swell its army of workers. To secure them, the annoying problem of caring for their young children must first be met.

As a result of existing circumstances and the factors surrounding the origin of our wartime child care programs, a number of conditions have grown up which are not to the best interests of the children and which *must be eliminated from any post-war development of the nursery school program.* They are the separation of small children from their mothers for long periods, the centralization of controls which estranges the school from the home, the toleration of custodial programs that lack recognition of basic child development needs, the employment of inadequately trained personnel, and the use of space facilities unfitted for children's needs.

There is complete agreement among trained and experienced workers in the field of child development that the present expanding program of day care for children of working mothers is, by and large, fundamentally unsound. For normal, wholesome growth children must have their basic need for affection satisfied. Nor is affection of any value unless it is demonstrated to the child in sufficient quantity and in terms he can understand. He must possess a feeling of security, of being wanted, of belonging. For the small child nine or ten hours represents almost his whole day. Even though a mother loves her child, if she leaves him so long each day she deprives him of elements that are essential to his emotional health. If his mother does not *have* to work, she is putting him aside for something which is to her, for the moment at least, of greater importance. And the child is not fooled into any other view of the situation.

Most of the newly established children's centers,

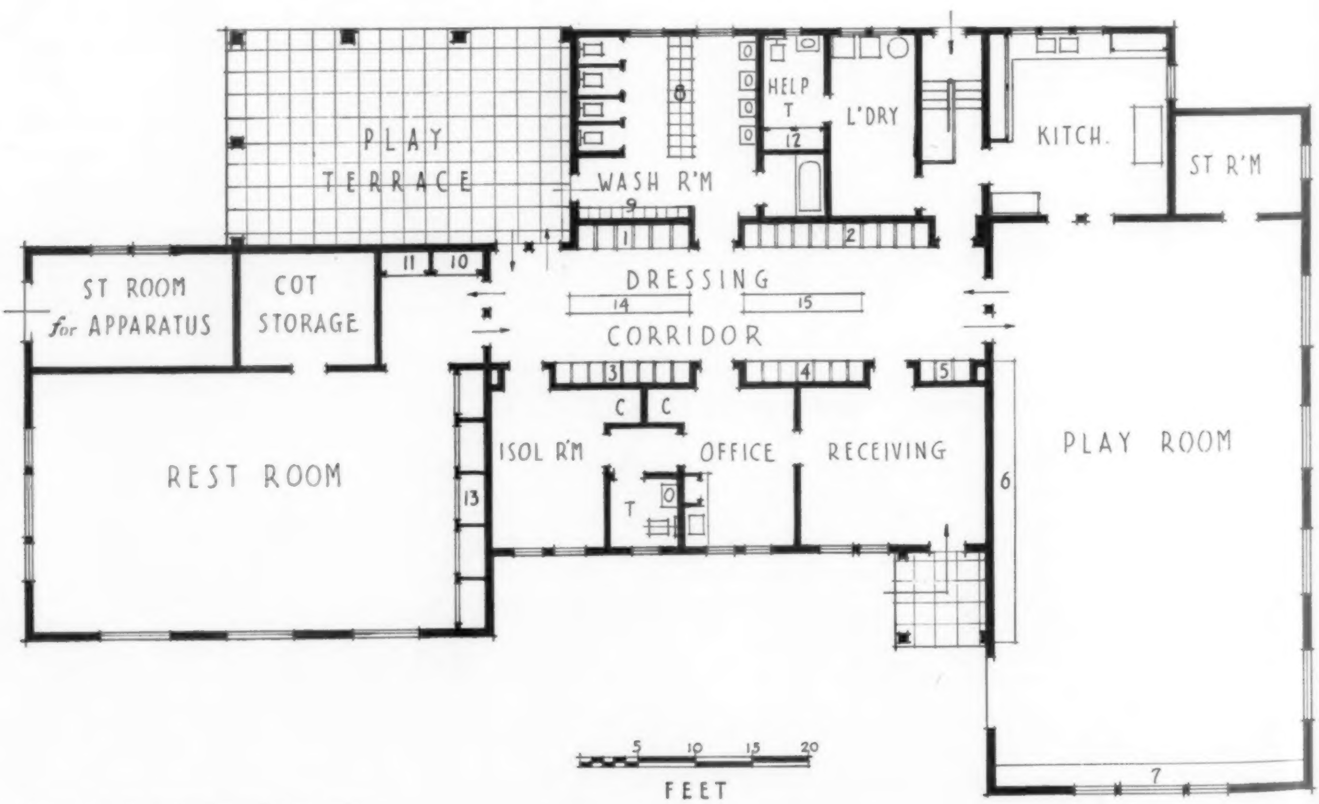
whether of an educational or a custodial character, are financed in large measure by federal funds. So far control has remained essentially in local hands. But there remains the danger in such a situation of the gradual assumption of controls by a federal agency, originally created during depression years under a different name to dispense relief perhaps, but which uses the power of federal money for self-aggrandizement and self-perpetuation. The farther the operational control of the nursery school moves away from the home of the child, the more we may expect to find a lessening of unity between nursery school and home, a lessening of inclination and ability to effect essential adjustments between the child and his home situation. Aside from the immediate harm, such an insidious trend strikes at the very roots of democracy by removing control from those who are controlled. The same charge can be leveled with equal validity against those day care centers which are maintained on a paternalistic basis by employers, "free of charge," for the benefit and gratitude of the employed.

Under the pressure of war needs there are springing up many child care centers which offer what is frankly little more than a custodial program. They see to it that the child is returned physically unharmed to his parents at the end of each day's work shift. Often manned by a staff inadequately trained and experienced in the technical field of child development and nursery education, little can be done by these agencies beyond attending to children's most obvious physical needs. To undertake corrective measures in situations involving poor social habits, emotional maladjustment, or the impairment of health is for the most part out of the question. Often little can be attempted in maintaining a desirable program for normal development even where individual problems are not considered.

The sudden expansion of nursery programs has created a dearth of professionally trained child development specialists. Despite a tremendous program of training designed to supply sorely needed assistants, their experience necessarily will be meager, and their knowledge superficial, for many months to come. Although the shortage of persons competent actually to direct nursery school work will continue for some time, we are building a tremendous personnel backlog which will go far toward putting the post-war program on a sound professional basis.

Finally, the greatly increased demand for a number of children's centers has resulted in the use of spaces that are poorly adapted and even wholly unfit for the use to which they are being put. Made-over residences with their chopped-up room arrangements, inadequate exits, and unsafe design and construction; ordinary, barren schoolrooms in half-filled old school buildings, or leftover basement space in crowded ones; federal housing project "community houses," hastily converted to make shift after it had been belatedly discovered that something *must* be done about the bothersome child care problem—these are typical quarters for our wartime program.

When at last this war is over and we can go about



Prepared by the Oakland Board of Education

Floor plan of a proposed nursery school for Oakland, California. Legend: 1 to 5–coat lockers, 6 and 7–toy cases, 8 and 9–towel lockers, 10 and 11–supply closets, 12–coat closet, 13–bedding cabinets, 14 and 15–benches

Howe and Lescaze, Architects

Interior view of the kindergarten, Oak Lane Country Day School, Oak Lane, Pennsylvania

setting our house in order, these are elements of our children's programs which must be corrected. They must be publicly supported or subsidized so that they may be available to all children regardless of economic status; they must be designed first and last around the needs of the children themselves; we must maintain the intimate relationship between parent and teacher, child and home; we must see to it that our nursery schools are schools in fact and not just places of detention; we must demand skilled leadership; and we must provide the housing and the equipment that is suitable for little children and for the operation of the sort of program they need.

Proposals for Satisfactory Programs

It is probable that three rather distinct types of children's centers will emerge, best designated perhaps by their daily hours of operation. They are the six-hour, the ten-hour, and the twenty-four hour types.

The six-hour program is the one with which we in this country are most familiar. It accepts the child for a few hours each day. The program is long enough for the child to reap full benefit from it. But it is not so long that he suffers from a lack of parental contact, and love, and security. Finally, it provides the mother with a few hours each day that are free for the performance of household tasks, for recreation and other essential pursuits, yet it leaves with her full parental responsibility and actively helps her to become a more skillful and understanding mother. It is the program which in the past has been, and which in the future will continue to be, the foundation and backbone of the nursery school program.

The ten-hour program, whose fundamental shortcomings have already received comment, will in all probability remain a necessary type for a long time despite its faults. There will continue to be mothers who *must* work for one reason or another. But we must recognize the dangers to the child and erect suitable barriers against his exploitation by parents who would shirk their duty for the sake of money.

Finally, the twenty-four hour program will be designed to take children for a few days up to several weeks, depending upon the needs of the child himself. It will provide for the child who needs a complete change for his health or for his emotional readjustment. It will provide for him a trustworthy haven during emergencies at home, such as when his mother is ill. Sometimes perhaps, as in Sweden, it will make possible a refreshing vacation together for young parents, freed for a little time from their exacting responsibilities.

There is a variation of this latter type that deserves mention in any consideration of post-war nursery school development. It is one which has been operated by the Gray Sisters, an order of the Roman Catholic Church in Australia. To this center the mother comes for a fortnight or so after leaving the hospital where her baby has been born. Here her other small children have been cared for during her confinement and here they will remain near her during her convalescence. While her children receive the benefits of a thoroughly sound nursery school program, the mother is provided a valuable and intensely interesting course in mother-craft. She learns by actual practice the best techniques of bathing, of mixing formulae, of feeding, of dressing her baby, and of making his clothes. She receives through counsel and observation an insight into the developmental requirements of her children.

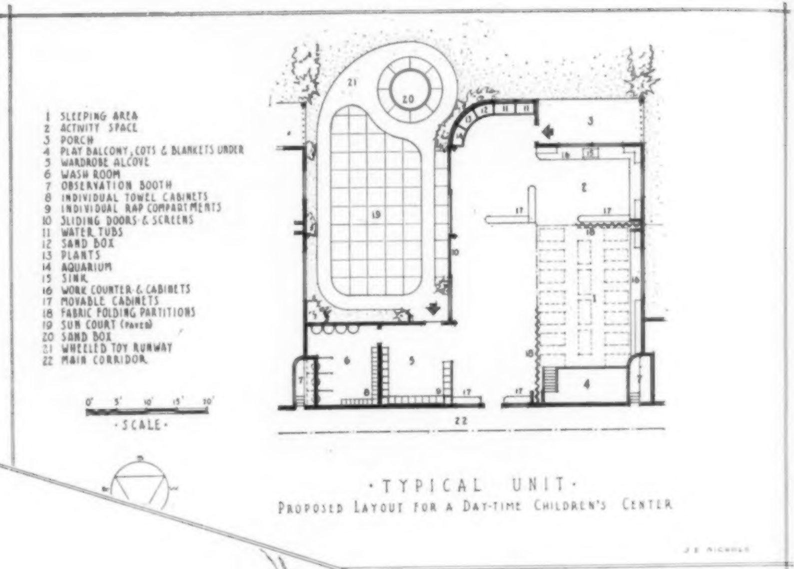
Physical Details of a Good Nursery School Program

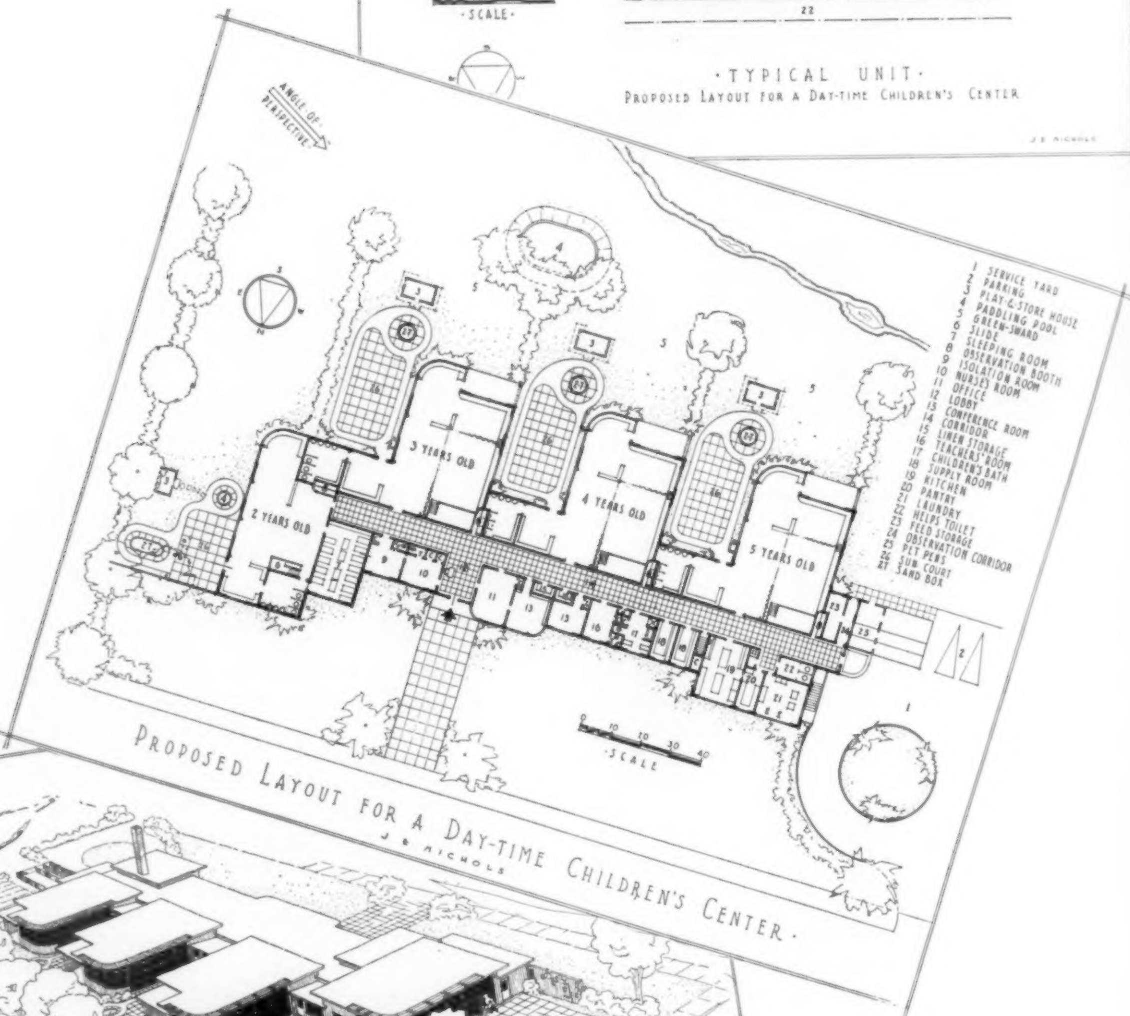
It is probable that the most useful children's center, and therefore the most successful, will serve a comparatively small area. If busy mothers must stop to transport their children to nursery school, we may be sure that many children will be deprived of the experience. Yet small children cannot be expected to walk any great distance—even where dangers from traffic have been minimized by thoughtful community planning. In view of this consideration most children's centers will be comparatively small, serving only those families living nearby. They will be designed for from one to four or five groups of children totaling from fifteen to a maximum of about ninety.

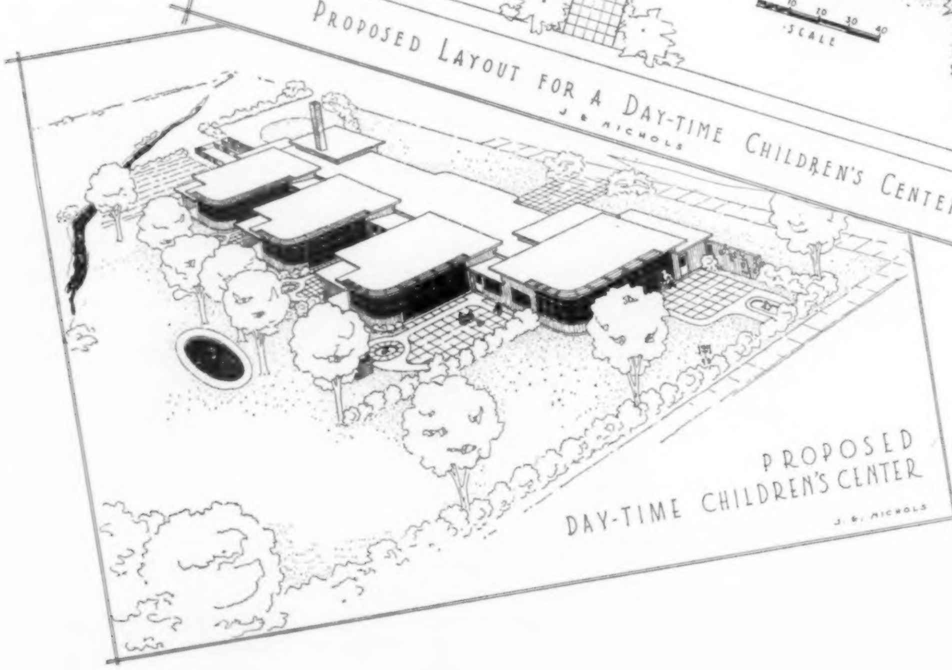
These schools will not be housed in imposing structures of brick and limestone. They will not appear to be institutions at all. They will look like what they are—unaffected, friendly, restful places, full of warmth and abounding in interesting things to learn and to do. The money that goes into them will not be spent on structural elegance or long life, but will be used in full for providing the working tools for a program that will have value and variety.

They will be designed, usually on one level, close to the earth. All rooms will be near the out-of-doors, in appearance and in use. Exits will be plentiful, permitting less expensive construction. The single

The children's center — unaffected, friendly, restful, designed for from one to five groups of children totaling from fifteen to ninety at the most







level will facilitate moving equipment from room to room—steam tables, for example, with children's lunches from the central kitchen. Under no circumstances will there be rooms below ground level—even partially so—for the use of children. In congested areas, however, it may be feasible to use the roof for play space to supplement an inadequate site. Here the paved surface can take the place of those surfaced areas on the ground which are used for sidewalk games and for play with wheel-toys and balls. In these cases, part of the roof playground should be provided with the shelter from sun and rain that trees and awnings furnish below.

As each child arrives in the morning he will be examined immediately by the nurse or a trained teacher, who will know him so well that anything unusual will be quickly detected. If he is not well or if he is a potential source of infection for other children, the isolation room waits to receive him. Here he remains only until he can be called for. The isolation room will be as cheerful and as full as possible of interesting things to do. It will have connecting toilet facilities, of course, and in the walls will be glass panels so that he may see and feel near the children in adjoining rooms—and in turn be kept under observation by nurse or teacher.

Perhaps one of the most important features of the children's center will be the opportunities and the facilities it will provide for work with and by parents. Worthwhile accomplishments with children are utterly dependent upon cooperation in the home by the parents themselves. The school cannot build good health and good eating habits nor can it establish desirable toilet routines and the desire for self-help and sharing, if what it does is undone at home. The nursery school program will include parent education at the top of its list. Mothers and fathers will receive sympathy and very practical and specific help through consultation, through group classes, reading, observation, and actual work among the children. For this purpose there will be a staff pediatrician, a child psychologist, a psychiatrist, a dietitian—working on a divided time basis among a number of centers—and the building will provide a classroom, consultation rooms, library, and observation booths.

There will be a well-equipped kitchen under the dietitian's direction, where simple, wholesome meals may be prepared and served to the children at little tables in their playrooms. The children will be welcomed in the kitchen, where they may add to their growing store of experience.

Acquaintance with animals, the freedom from fear of them, and skill in tending their needs will be afforded by the presence of pets. Pens and runs will be provided for them. Here there will be permanent mascots and the visiting pets of the children.

The children will be divided into small groups, roughly according to age and interests. The groups will be much smaller than they are in most kindergartens and elementary schools. Groups of two-year-olds, for instance, will be limited to ten or fifteen, while for older children the numbers may be increased to twenty or so. Nursery school children require infinitely more individual attention than do older ones. Groups must be small enough to enable a teacher and her helpers to attend their needs. Moreover, larger groups are definitely confusing and over-stimulating.

Each group will have its own playroom, auxiliary rooms, and play yard, designed as a unit and adapted to most of the children's activities—play, eating, and rest. Specialization of sleeping space will be necessary, however, in the case of two-year-olds. These children are unable to set up and store their own cots and blankets. Moreover, their naps are so long and there is so much variation among them in the amount of sleep they need that a permanent sleeping arrangement will be a practical necessity. The sleeping room should open directly off the playroom, and the toilet room should be connected with it. It should be quiet, well ventilated, and equipped with shades that permit dimming the bright daylight.

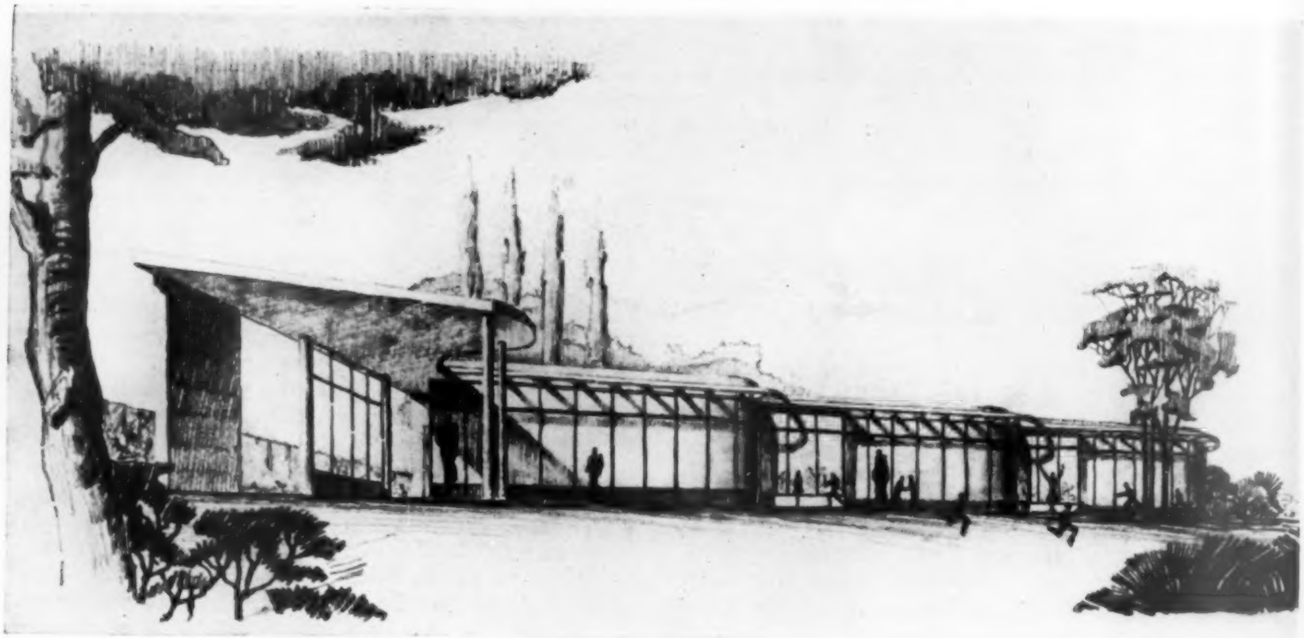
The main group of rooms themselves will be light and sunny because of their south and east orientation and their lavish use of glass. Rolling glass panels extending from floor to ceiling will form a large part of the outer walls. In warm weather, when the panels are rolled back, the room itself and the sun court and lawn may be used as one. To control the sun's rays on hot days we shall borrow the Brazilian technique of using an overhanging cornice of adjustable louvers. In summer, too, the glass panels will be supplemented by screens to keep out insects. Double glazing will be used to reduce to a minimum the chilling effect of the large surfaces of glass in the winter.

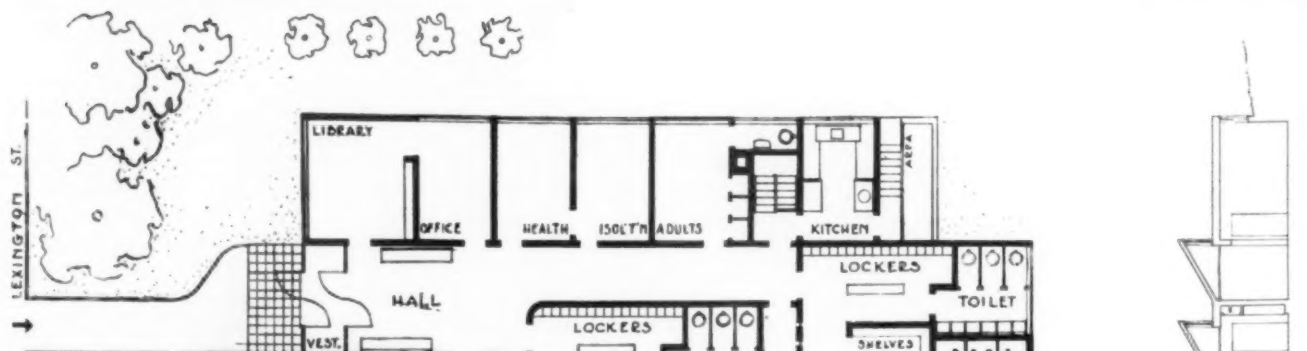
The large rooms will be broken up by low screens and cases into smaller areas where a variety of activities may be carried on independently of one another. Large open floor areas invite—almost demand—racing and rough-housing. These low partitions will afford the teacher an uninterrupted view of the room at all times, yet they will provide those corners that are so essential for playing with dolls and building with blocks away from the traffic areas. The screens and cases will, of course, be portable, so that arrangements may be altered at will.

Each room will have a play balcony where children may, if they wish, play quietly alone or in a small group. There can be slides built in conjunction with the balconies, for small children get fun and exercise and self-confidence from climbing the steps and sliding down again. In the accompanying plans which have been drawn to illustrate this article, there are cases for the storage of the folding aluminum frame cots and the bedding—each child having his own.

Each room will have its work sink and its generous cupboards for storing the tremendous quantities and varieties of play equipment and materials. Some shelves will be open so that the children may have ready access to them. Others will be closed for purposes of control. Each room will have its aquarium and its growing box where the life and habits of plants and fish may be observed. And there will be tubs or tanks, either built in or movable, where boats may be sailed. Overlooking each group room will be a small, well-ventilated observation booth. Here mothers, students, and teachers, behind a one-way vision screen, may observe and learn from the behavior of children without distracting them by their presence.

Because so much of children's play utilizes the floor, special attention must be directed to the problem of heating. More and more panel heating will come into use—especially the floor type which makes that entire surface a warm, low-temperature radiator. Floor surfaces themselves will be a smooth, easily





BRATTLE STREET

Walter Gropius, Architect

A Proposed Nursery School

cleaned material such as linoleum, rubber tile, or cork. Ceilings will, of course, be acoustically treated. Artificial lighting will employ a system of shielded fluorescent tubes. In addition, there will be germicidal lamps which will do much to kill air-born bacteria and prevent the spread of colds and other diseases. All finish materials, in so far as possible, will be capable of being thoroughly cleaned with soap and water. Colors will be light and cheerful. Instead of the blatant "Mother Goose" type of murals, the decoration, like the physical arrangements, will be quiet, simple, and composed.

Each group room unit will have an alcove where individual open lockers will hold wraps and overshoes. There will also be a connecting toilet room, convenient to both the main room and the outdoors. Here additional individual open cabinets will hold toilet articles and a change of clothing.

The wardrobe alcove for each unit will open immediately onto a separate sun court which, facing south, will be sheltered and warmed by the sun during much of the spring and fall. Here the children may play with their toys on the pavement, ride their tricycles, or venture out upon the turf. Near the sand box will be the playhouse, which will serve also to house the outdoor toys at night. A wading pool will be situated so as to serve all groups conveniently and nearby a garden will provide an opportunity for children to dig in the soil and learn how to grow plants.

The twenty-four hour type of children's center will be much the same in principle. The main difference will be the provision of separate sleeping space for all children, with beds arranged in individual, low-partitioned alcoves. There may be also a separate dining room. Living quarters for the teaching and service staffs will, of course, have to be provided, arranged if possible so that children's sleeping rooms may be kept under convenient observation from the staff's living rooms. Such centers must make more elaborate provision, too, for the accommodation of extra clothing, linen, and food, and for bathing and dressing.

Conclusion

There are many trained persons in nursery school work who look with some misgiving upon any move to incorporate the child development program into the established public school system. They fear, perhaps with reason, that the academic influence of the traditional school will close with deadly effect upon a program that *cannot* be academic, that *must* concentrate on helping each child to develop healthy and normal habits and personalities as a groundwork for wholesome adulthood. It is a program which *must* treat each child as a separate individual. Our public school tendency toward mass methods would be utterly fatal if applied here.

Yet the most significant developments in public education have had their beginning in the lower grades and have spread upward. It is a process that still continues. It is certainly within the realm of probability that not only might the established school system do much to help the nursery school program take advantage of a recently developed public interest in and acceptance of it, but that the nursery school program itself can do much to improve the established pattern of public education. It will gain the child nothing if the good work of the nursery school is allowed to languish from kindergarten onward. For, after all, the child is the thing—not the program.

Exterior of the Jenny Tucker Baker School, showing the walls which separate each classroom from the adjoining areas

INTELLIGENT PLANNING OF CLASSROOM LIGHTING FOR ONE-STORY BUILDINGS

By HENRY L. WRIGHT

Kistner & Wright, Architects, Los Angeles, Calif.

DURING the past twenty-five years educational requirements and methods have undergone considerable change. Educators have come to realize that in order to develop properly the personalities of children, the school environment must reflect the subjects they are being taught.

The classroom of today is larger, is equipped with specially designed cabinets and furniture, and has more adequate ventilation and light so that both the children and the teacher may perform their tasks in healthful, pleasant, and orderly surroundings. Classrooms are now planned with "space for doing" so that throughout the day informal groups may work with tools, while others are reading, drawing, sewing, etc., all over the room. Because of these various activities, we can no longer consider "light over the left shoulder" as adequate; there must be an even distribution of light throughout the room, controlled to eliminate excessive brightness and at the same time provide sufficient intensities during the school day.

Classrooms Geared to the Activity Program

One of the most recently constructed schools that embodies these features is the Jenny Tucker Baker School, in the Mountain View School District, near El Monte, Calif.

As usual, there were limited funds in the school treasury. Wood frame and plaster construction of the most conservative form was used, and a very successful plan was developed which contained all the features that are necessary for a modern activity school program.

The classrooms are 24 by 38 ft., with built-in cabinets for storage of supplies. Equipment is placed around the room to leave as much clear space as possible for movable tables and chairs that can be arranged to suit the special requirements of the various activities. Each classroom was provided with an additional outdoor classroom formed by cement tile walls 5 ft. high, enclosing an area 38 by 45 ft., with a concrete platform under a veranda on one side where a sink, a drinking fountain, a work bench with two vises, and a tool cabinet are located for large projects. The remaining area is paved with disintegrated granite, except for a strip of top soil around the walls for small gardens. The important feature of this outdoor classroom is its definite separation from adjoining areas, so that each class can carry on its own activities without disturbing other classes engaged in similar pursuits.

Making the Most of Natural Light

All classrooms are provided with bilateral lighting, which consists of high clerestory windows over an ar-

cade on one side of the room, and large windows extending from the ceiling to within 3 ft. 6 in. of the floor on the opposite side of the room. All these windows are equipped with fixed louvers made of redwood built-in units for each individual window. They are designed to permit the maximum of light into the room, and spaced so no one can see outside from the classroom. This was done to eliminate the sky brightness from the window areas which is one of the greatest handicaps to pupils in the conventional classroom. The louvers are painted on the outside surfaces with aluminum paint, which permits a maximum of light reflection. They are painted a redwood color on surfaces visible from the inside, thereby reducing the brightness of the window areas. The interior wall surfaces are painted pale yellow with a suggestion of green, providing a reflection factor of 60%. The ceiling is painted flat white with a reflection factor of 80%. The results proved very satisfactory; for it was found by actual tests that the ratio of intensities taken from readings under various daylight conditions was approximately 2:1 from the large window side of the room to the opposite wall where the clerestory windows were located. In the morning, on a clear day, the minimum intensities are 20 foot candles on the arcade side of the room. In the afternoon of a clear day, the intensities are uniform at about 15 foot candles. Whenever the sky is overcast, the intensities are uniform and are high or low, depending upon the lightness and darkness of the overcast.

In order to minimize the brightness contrasts in the room, all "writing panels" (blackboards) are brown composition board and the woodwork is a lighter shade of reddish brown to blend into the wall color. The color of the woodwork was a compromise; it was not considered practical for maintenance purposes to paint the woodwork a light color.

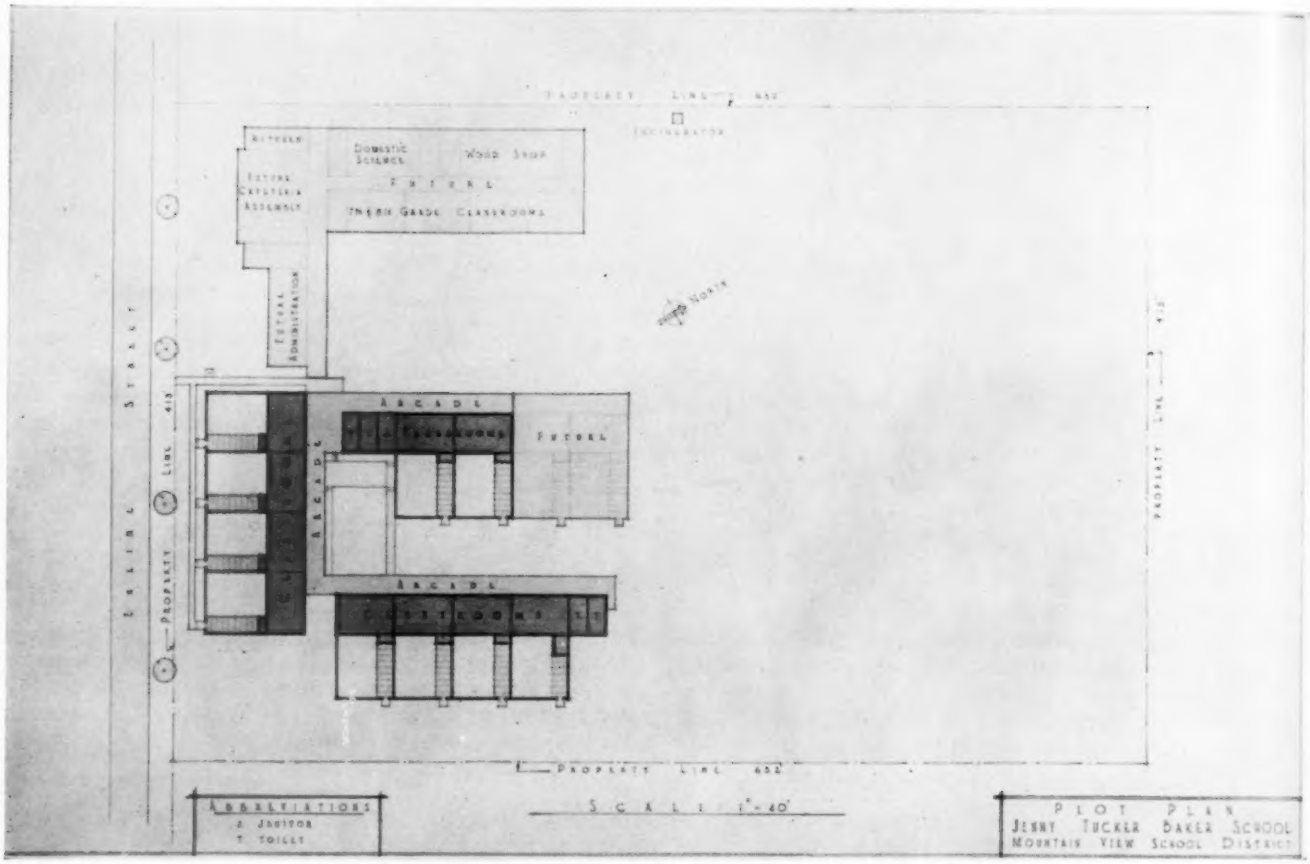
An interesting discovery was made after the school was completed. It developed that because of the location of the school site it was not practical to orient the classrooms so that all large window areas faced north. It was necessary to face some south and some east. This made little difference, however, in the uniformity of light intensities of the rooms on either exposure.

Provision for Artificial Lighting

Artificial light was provided in sufficient quantities to supplement daylight on dark days. The fixture chosen is made of three concentric rings surrounding a silver-bowl lamp to hide the brightness of the stem and at the same time to produce an efficient indirect light. This fixture requires the minimum maintenance because the only reflecting surface is within the bulb. Six 500-watt fixtures are used in each classroom. Each switch operates three in a row, so that a closer

View into an outdoor classroom and toward the clerestory windows over the arcade

Interior of a typical classroom. The windows on both sides are equipped with fixed louvers to eliminate sky brightness



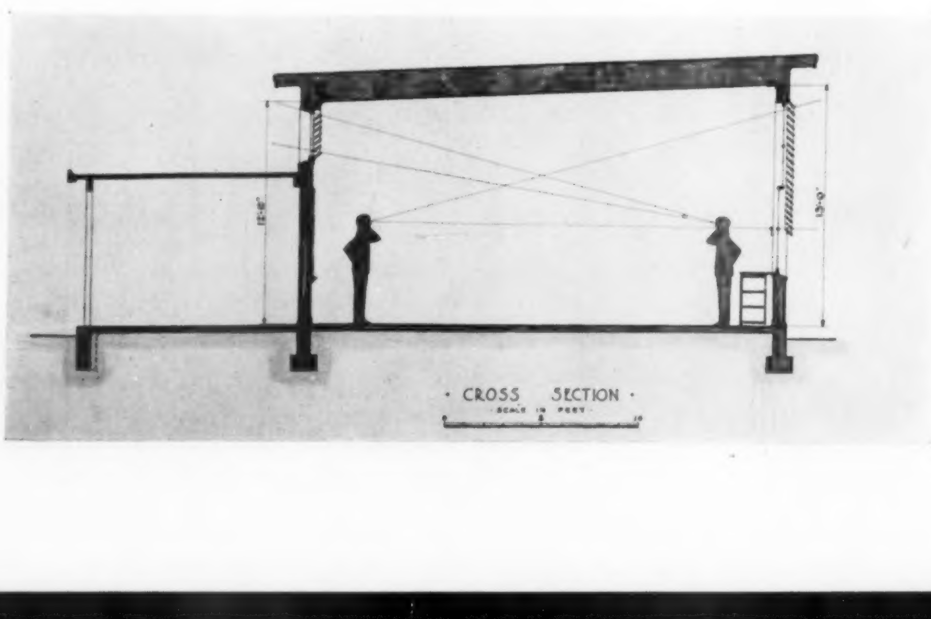
Plot plan of school, showing provisions for future extensions

control can be maintained as the intensities change. More positive control could be provided if the lights were operated by photoelectric cells; but limited funds did not permit this expenditure.

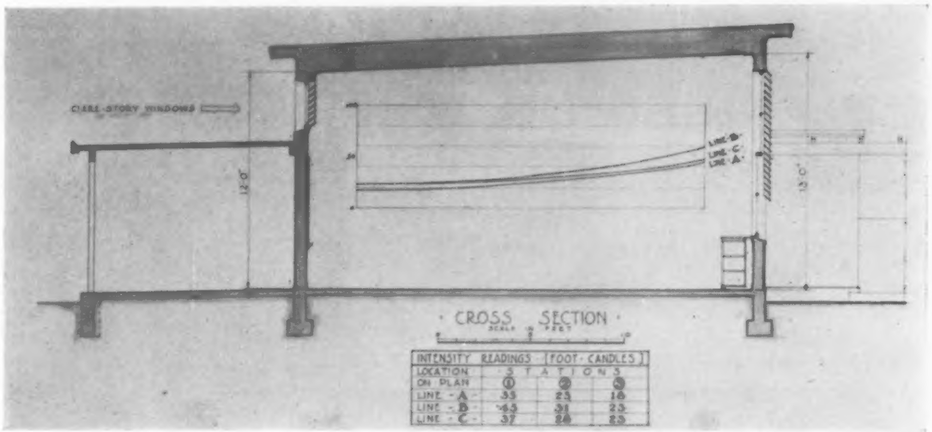
Suggested Improvements for New Construction

After every building is completed and put into use, there are always changes to be made "if we had it to do over again." The experience gained through the construction of this school indicates that only minor changes would have to be incorporated in another building of this type. The important features of this building, together with slight revisions, are summarized as follows:

1. Provide bilateral lighting for even distribution of natural light, with more light on the "inside" wall, at the same time allowing any orientation of classrooms without sacrificing a workable plan.
2. Increase ceiling heights to 14 ft., with as much large window area as structurally possible, using a 4-ft. windowsill height and similarly as much clerestory window area as possible on the opposite side of the room.
3. Fit all windows with fixed louvers of metal, which



Cross section of a classroom, illustrating the sight lines required for the proper spacing and angle of the fixed louvers allowing light to enter the room without seeing out

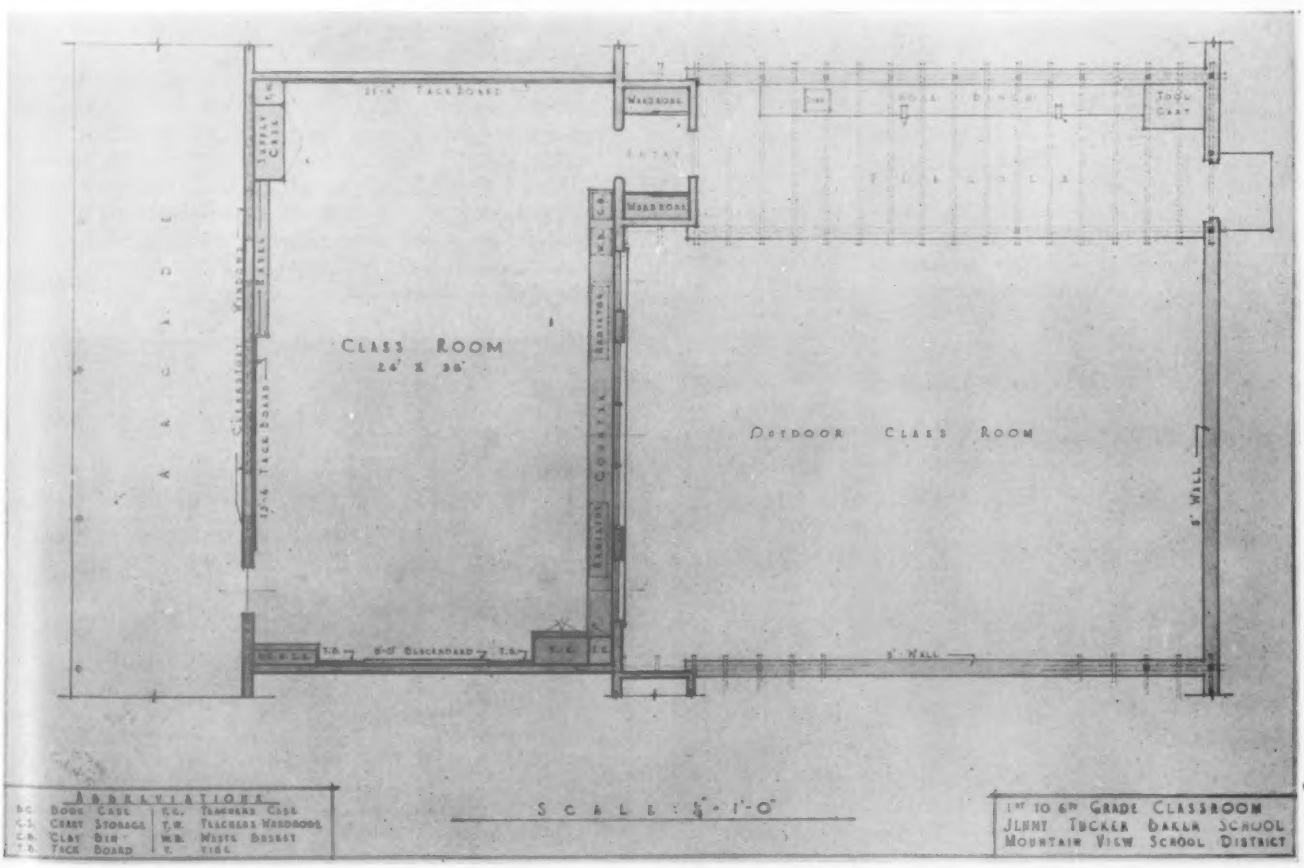


INTENSITY READINGS	[FOOT-CANDLES]	
LOCATION ON PLAN	STATIONS	
	①	②	③
LINE - A -	35	23	18
LINE - B -	45	31	23
LINE - C -	37	28	23

Diagram and table of average readings taken with a light meter illustrate the ratio of intensities from the window side of the room to the corridor side of the room

are thinner, more durable, and easier to clean than the redwood used in our building. The reflecting area of louvers should be painted with a high-reflection-factor paint on outside surfaces; and areas visible from inside the classroom painted a darker color to even up brightness contrasts within the room.

4. Paint the classroom interiors with colors having an 80% reflection factor on the ceiling, 55 to 60% on the walls, and 40% on woodwork, furniture, and floors.
5. Provide indirect artificial light, using six 500-watt silver-bowl incandescent globes, in a concentric ring fixture mounted 48 in. below the ceiling to reduce brightness on the ceiling when fixtures are lighted.
6. Arrange photoelectric cell control of artificial lighting so that all six fixtures light at once and maintain the even distribution provided by natural light.
7. Eliminate glass panels in doors leading from classrooms directly to the outdoors, in order to reduce brightness contrasts in room.
8. Provide tackboards and writing panels to harmonize with the wall color, for a transition of color rather than a direct contrast. (Composition boards and cork carpet are now manufactured in various colors.)



Floor plan of a typical classroom and outdoor classroom

PLANNING THE SCHOOL OFFICE—A SYMPOSIUM

The Secretary's Viewpoint

From Springfield, Massachusetts

ELEANOR M. DEARDEN

shows how functional planning for a new or remodeled office will make it comfortable and attractive as well as efficient

FOUR major considerations should receive the attention of any school administrator who is responsible for planning administrative offices, whether they are to be located in a new building or in an old school building remodeled for such use:

1. The arrangement of space for accomplishing most effectively a maximum amount of work with a minimum of effort.
2. Provision of adequate and proper equipment for the performance of an efficient job.
3. Provision for the physical comfort of the workers.
4. Provision of attractive surroundings in which to work.

Careful analysis of the major functions of the school office will enable the administrator to incorporate all these items into his plans.

Effective Arrangement of Space

Every office should be planned according to its specific activities; and a detailed analysis of the work to be performed should precede any preparation of floor plans. The function of each department, as well as the relationships among the various departments in the administrative office, should be carefully analyzed. The relationship of each department to the public should also be studied. Departments that have the most direct contact with the public should be allocated space which is most readily accessible, if possible on the first floor near the entrances. Staff officers most closely associated with the superintendent should be placed near his office, and departments whose work is correlated with these staff officers should have adjacent offices. Consideration should also be given not only to present needs but to the possible future expansion of each of the various departments.

Before space is allocated it must also be decided whether or not a centralized stenographic service and centralized filing system are desired. This type of service is effective for the accomplishment of general, non-specialized clerical work which requires little understanding on the part of the clerks of the particular problems of the several departments. Because the typical administrative or supervisory officer, however, has much work of a highly specialized nature, his secretary can usually render the most effective service in a room adjacent to his office with ready access to all files and materials pertaining to his work.

Rooms should be provided for staff and committee meetings. Too often, principals and teachers have little knowledge of the functioning of the central office or the services it can render them. Provision of rooms for meetings of large and small groups serves to acquaint staff members with the central offices and their

The counter file in the office at Springfield serves a double purpose. It is a barrier for the public and houses the complete files of the office. The booklets on top of the counter are the yearbooks of the high schools in the system, put there for people to read while waiting for appointments

The business office at Springfield. Proper lighting—both natural and artificial—in an office of this kind is essential for efficiency and cheerfulness. The color of the wall paint can improve the appearance of an office that suffers from too much or too little natural light

The duplicating room is an unusually well-lighted work room and it has ample shelving and work tables. Shelves go all along one side of the room, thirty feet or more. Because of the noise the machines make, it is essential that they be housed separately from the office, in a good-sized room

facilities. A professional library which makes available the most recent books on education also adds to the efficient performance of the work.

The location of the central storehouse in or near the administrative office building has distinct advantages.

In the remodeling of an old school building for an administrative office certain factors must be taken into consideration, particularly if there are limited funds available for this purpose. The location of existing partitions, the arrangement of doors and windows that cannot easily be changed, and other structural features of the building sometimes make it necessary for rooms to be larger or smaller than might be desirable.

Within these limitations, provision should be made for the following:

1. A reception room or area for visitors.
2. Office space for secretaries, separated from the public by a counter to insure a degree of privacy.
3. Private offices for superintendent and supervisory staff.
4. A workroom for duplicating, mailing, etc.
5. Fireproof vault or storage room for important records.
6. Storeroom for office supplies.
7. Space for filing equipment to take care of necessary records and other data.
8. Rooms for staff and committee meetings.
9. Professional library.
10. Rest rooms and wardrobe facilities for employees.
11. Central storehouse or warehouse (if possible).

Office Equipment

Authorities in the field of school administration agree that the equipment with which an employee is provided largely determines the quantity, quality, and cost of the work accomplished. Office equipment need not be elaborate or expensive, but it should be suitable and sufficient to give the office dignity. Labor-saving devices of every description aid greatly in the efficient performance of work.

In planning for mechanical equipment, sufficient provision should be made for expansion so that additional equipment may be installed at a later date without need for altering major electrical circuits. Many mechanical devices, such as the duplicators and addressing machines, are noisy; and the nature of the work performed by them is such that they should be in a room apart from the general office. Not only should all types of equipment be provided, but they should be kept as up-to-date as possible. Work cannot be performed efficiently on antiquated machines.

Healthful and Comfortable Surroundings

The physical comfort of workers is another highly important feature if a desirable *esprit de corps* is to be developed among employees. An adequate heating and ventilating system, proper lighting—both natural and artificial—proper acoustical treatment to eliminate noise, suitable floors, and the like, all should receive consideration. When partitions are built in an already existing school building, care must be taken to prevent interference with the heating system, so that proper radiation of heat is maintained in each new room.

A Pleasant Place in Which to Work

The greater portion of a person's waking hours are spent at his work; it is therefore most important that the surroundings be cheerful and attractive. It is not necessary to use drab tones for the walls of offices. A little thought and ingenuity make it possible to have rooms attractively finished. Pastel shades, selected according to the amount of natural sunlight which normally enters the room, do much to brighten an office and to give employees a cheerful outlook. The delicate shade of green known as "eye-ease" is good in a room that gets a great deal of sunlight. Rooms with northern exposures can be treated with warmer tones like rose or rose-beige.

When a visitor exclaims, "What an attractive office—and such a quiet place in which to work!" it is praise that indeed reflects credit upon the school administrator and his ingenuity in planning the office.

Location of the central storehouse of the school system in the same building as the business office is a well-thought-of feature of the planning at Springfield. This picture shows a section of the store room with shelves holding general school supplies in the foreground

From Denver, Colorado

ALBERTA B. CORDIER

shows how important it is to plan the details carefully if the host of functions of a large school system are to be carried out smoothly

OFTEN the quality of the service which the secretarial or clerical workers can give is definitely affected by two factors: good office arrangement and equipment. The planning of the administrative office or offices, therefore, becomes a matter of consequence from this viewpoint.

The Secretary's Desk

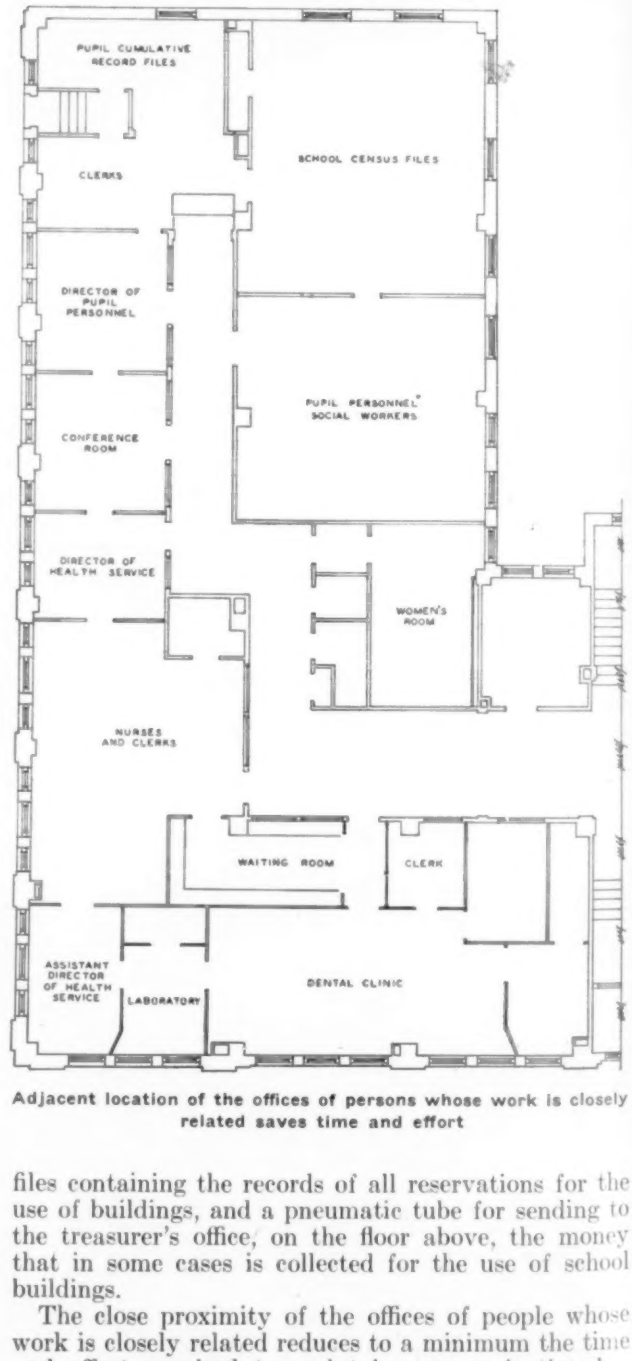
One important function of a secretary is to keep things running smoothly and effectively between the executive and the demands made upon him, and good office arrangement can be helpful to her in carrying out this function. The location of her desk with reference to the office of the executive for whom she works is important. She should be able, without leaving her desk, to see people enter and leave the executive's office. If this office has two doors, she should have a view of both from her desk. Her judgment regarding the handling of telephone calls, messages, requests for appointments, and the like, can be more discriminating if she knows who is in the executive's office. If her desk is properly located, such information is available to her without any wasted motion.

The secretary's desk should at the same time be placed so that she is accessible to people who come to the office for information or assistance. This is important not only because it facilitates what is usually a necessary part of her work, but because this phase of her activities has value in the development of that vital component of efficiency, the ability to deal with people effectively.

Type and Arrangement of Equipment

Office arrangement and equipment must, of course, suit the needs that are to be served in particular instances. Perhaps the accompanying illustrations of equipment that meets the needs of a large school system may be suggestive of principles applicable in other cases.

Compactness in the arrangement of materials and working instruments promotes ease and speed in the discharge of certain duties. The accompanying picture shows the application of this principle to the desk arrangement of an employee who is in charge of making arrangements for the community use of buildings, an important part of the activities of a modern school system because it is an effective means of developing good will toward the schools. A curved counter, adjacent to the desk, is 39 in. high—a comfortable height for a person filling out the required application blank, which can be handed to the applicant directly from the desk. The inside of the counter has shelves that provide space for storing the materials needed in this work. Within easy reach of the desk are the visual



Adjacent location of the offices of persons whose work is closely related saves time and effort

files containing the records of all reservations for the use of buildings, and a pneumatic tube for sending to the treasurer's office, on the floor above, the money that in some cases is collected for the use of school buildings.

The close proximity of the offices of people whose work is closely related reduces to a minimum the time and effort required to maintain communication between them. Often, however, this is impracticable. In such a case the dumb waiter with a buzzer signaling

The picture at the right shows the principle of "compactness" applied to the desk of an employee who is in charge of making arrangements for community use of the buildings. Counter, shelves, and files are within easy reach. At the left is the office of the secretary of the art director with special cupboards built to house art materials

system, the pneumatic tube, and the like, may be used between offices to send back and forth papers and other materials necessary to the work of both offices.

Design as Affected by Function

The function of an office naturally influences its design. The accompanying picture of an art director's office illustrates in certain respects how this principle works. The art director's secretary maintains a continuously changing exhibition of material drawn both from children's work in the schools and from a reference collection of art materials. This exhibition constitutes a circulating art library from which teachers of art, social science, language, and other subjects, borrow pictures, textiles, and examples of all handicrafts. These are used in their classrooms to set up centers of art interest that increase the children's knowledge and appreciation of fine things and how they can be used to enrich everyday living; while the exhibits provide a means of introducing new ideas.

One of the equipment problems encountered in this office involved the storing of the diverse elements in the collection, for it necessitated the provision of several types of shelves and cupboards. One of the most serviceable of the cupboards has, in addition to the usual shelves, vertical stalls of different heights, with open fronts to facilitate the sliding in and out of color prints, as well as horizontal stalls for storing cases containing smaller pictures, and a space large enough for hanging textiles when they are not in use. Each of the four sections of the cupboard has a sliding door made of fiberboard, which is used for displays of the graphic arts.

Such considerations as those suggested by these illustrations of office arrangement and equipment, while at first glance insignificant, are nevertheless fundamental in the efficient and effectual operation of administrative offices in a modern school system.

The School Office Staff at Wilmington, Delaware

lays down a set of rules for school office layout and equipment that shows that orderliness, modern equipment, and labor-saving devices are appreciated

DO:

Have the school office on the first floor.

Have a bright and cheerful room equipped with well-constructed combination desks and comfortable posture chairs.

Use blinds or shades to regulate light.

Use sound-deadening materials.

Use quiet colors and carefully selected, restrained decorations.

Provide good lighting for night work and dark days.

Provide ventilators, electric fans, and window screens.

Provide sufficient space so that each office worker has adequate privacy for her work and sufficient space for all necessary furniture and equipment. At least 100 sq. ft. should be allowed for each employee.

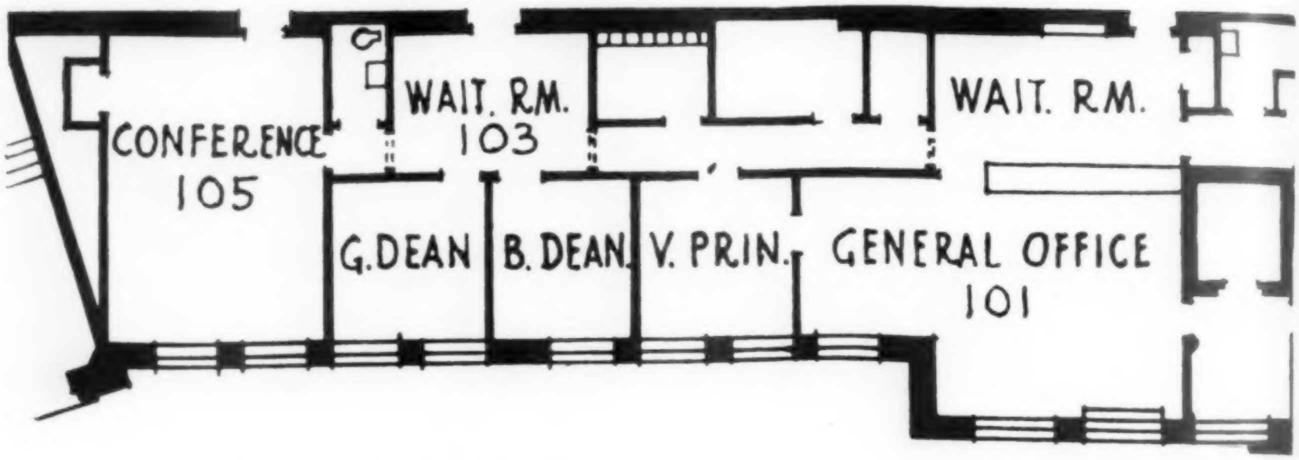
Provide adequate and convenient cloakroom and rest room facilities for employees.

Place the secretary's desk near the door of her employer's office.

Provide space for the expansion of files to avoid placing cabinets at awkward angles or inconvenient distances.

Provide a comfortable railed-off section for visitors to wait, with popular reading material close at hand.

Mark the entrance of each office plainly with the name and title of the occupant.



The offices in this school are grouped to the left of the main entrance on the first floor

Install a telephone on each desk.

Install a public address system and an intercommunicating telephone service.

Install a telephone in a prominent place outside the main office for the personal use of teachers, pupils, and visitors.

Build in a central place (the school office in a school building; a first-floor office in the administration building) a series of mail boxes and assign one to each employee or (in the administration building) to each office.

Hang bulletin boards for employees close to the mail boxes.

Hang bulletin boards for pupils in the main corridor.

Post prominently in the first-floor corridor a building directory giving names, positions, and room numbers of employees.

Provide a sufficient number of cabinets, storage places, trays, baskets, and shelves to encourage good housekeeping.

Provide adequate space for the storage of out-of-date materials outside of the office, probably in the basement or storage room.

Equip the office with such time-saving machines as are needed—a calculating machine, a telephone list finder, and a visual record card file.

Provide a separate, well-lighted room for duplicating machines, addressing machines, multigraph, mimeoscope, etc., and equip this room with cupboards and files for the storage of materials.

Provide adequate custodial service.

Main office of P. S. DuPont High School in Wilmington

DON'T:

Permit visitors to wait or approach too close to the office worker's desk.

Crowd too large a staff into a small room.

Waste space and energy by providing too large an office for the size of the staff.

Use garish colors and elaborate decorations.

Expect efficient, cheerful service in a poorly heated, poorly lighted, poorly ventilated office.

FACILITIES FOR CORRELATED WORK IN THE SCIENCES AND ARTS

By NORMAN H. DOLLOFF, CHARLES D. PRICE, WILLIAM SCHULTZ, Jr., and LLOYD L. WAITE

Instructors in Chemistry, Fine Arts, Physics, and Industrial Arts, respectively, Cranbrook School, Bloomfield Hills, Mich.

THE location of the science and arts departments of Cranbrook School before the erection of the present building was one which made correlated work extremely difficult. The various science laboratories were in separate wings and the industrial and fine art departments were in separate buildings. With the development of instructional methods requiring closer collaboration among the different science and industrial arts departments, it became necessary to make some arrangements to alleviate the situation. Consequently, in 1940, plans began to be made for the construction of a new building.

Major Considerations in Planning

To a very large extent, the planning was done by a committee composed of the instructors who would be using the building. Four main factors were considered to be of prime importance: flexibility, accessibility, supervision, and the interdependence of the arts and sciences.

Flexibility.—Probably the greatest factor taken into account was that of flexibility. In order to accomplish this, semi-movable partitions were used in the entire building. The only permanent walls in the interior of the building are those put between the two departments to reduce sound, dust, and fumes. These walls extend only half the width of the building, the extension being steel and glass partitions. The floor was constructed in such a way that there would be a 4-ft. pipe-space below, so that plumbing could be exposed and altered at slight expense. Gas, compressed air, and direct and alternating current outlets are spaced to be used wherever there may be a demand for them.

Accessibility.—The philosophy of science and arts education as developed at Cranbrook states that the facilities of laboratories, shops, and studios should be accessible to students at all times. Because there are no corridors in the building, students going to and coming from classes can observe equipment, demonstration materials, and activities in various areas. This is facilitated by the use of steel and glass partitions which allow observation from many angles. The laboratory and class sections are so arranged, moreover, that laboratories may be used by groups or individuals with a minimum of interference with classes being conducted at the same time. During the six months the building has been in operation, this has worked successfully; instructors and students alike soon becoming conditioned to various activities going on about them.

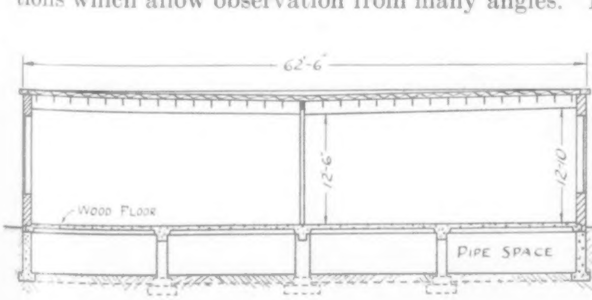


Fig. 1. Cross-Section of the Structure

Supervision.—In order that the laboratories can be supervised by one instructor during evenings or weekends, the offices are centrally located and separated from the laboratories by glass partitions.

Interdependence of the Arts and Sciences.—On one side of the building its entire length may be observed. The only section that might be considered as a corridor is the lobby between the science and arts sections, which has been designed to display various materials from both departments and might be called a hall of technology. Various outlets have been installed in the floor and are available for the construction of pilot plants or other operating devices.

Construction Features

General Overall.—The building is 267 ft. 7 in. long, measured from the outside walls. The width is 63 ft. and the height of the inside wall is 14 ft. The standard greenhouse is 33 ft. 6 in. by 18 ft. and the potting room is 22 ft. 6 in. by 16 ft. 1 in.

Foundation.—The floor is set on reinforced concrete piers spaced 19 ft. by 15 ft. (see Fig. 1). A 4-ft. pipe-space facilitates changes in plumbing.

Walls.—These are constructed of No. 1 hard-burned common brick and are 1 ft. thick. On the interior, they are faced to a height of 7 ft. with matt-glazed face brick. The exposed brick wall to the ceiling has had a coat of primer and sealer and a coat of free-flowing white paint. The chemistry laboratory has a coat of fume-proof paint. Pilasters are spaced 20 ft. 4½ in. apart. The center H-beams, 6 in. by 6 in., are spaced every 20 ft. 4½ in. The windows are of the canopy type with steel sashes and with 14 in. by 20 in. panes.

Roof.—The roof is supported by 18-in-by-6-in. I-beams. Upon these are welded open-web steel joists on 18-in. centers. The nailer strips on top support 3 in. of insulating material covered with ¾ in. of concrete and 5-ply tar paper. The roof is tarred and graveled.

Floor.—Reinforced concrete columns and slabs are used throughout the building. In the arts department, an edge-grain maple floor, with tongue-and-grooved edges and splined ends, is laid on top of the concrete slabs in a layer of mastic. A 2-in. cork expansion joint around the sides is covered by a shoe molding. There are no nails in the floor. It has been sanded

and filled with a penetrating wood filler, sealed, and buffed with steel wool. In the science section, a finish coat of cement was floated and a red asphalt tile surface laid in a linoleum mastic.

Partitions.—These are regular steel and glass office-type partitions (see Fig. 2). While some sections are all steel and others steel and glass, they are all movable. These extend upward 8 ft. 9 in. Above that point double-faced mineral board partitions rise to the girders.

Services.—These are extremely flexible. All services are easily accessible because of the 4-ft. pipe-space below the floor. Illumination is afforded by 4-ft. 2-tube fluorescent factory-type fixtures placed on 10-ft. squares. They deliver 50 foot-candles at table height with no shadow. Heat is supplied from the school's heating plant. Ventilating units have been installed, six in each half of the building and one in the lobby. These are supplemented by ordinary radiator auxiliary units. A small auxiliary boiler has been installed to heat the greenhouse at night. Natural gas as well as 110-volt and 220-volt AC and DC outlets are provided. Compressed air at 85 lbs. is available in all departments. There are hot and cold water services throughout the building. Fume hoods have been installed in the general science and chemistry laboratories, in the spray booth, and over the crucible furnace. The drainage is central, merging into a common acid-proof pipe. The roof drainage is through the middle of the building, the flat roof sloping slightly toward the center. The ceiling of the chemistry laboratory is suspended on steel lathes and is plastered with concrete. This surface is painted with fume-proof paint which prevents fumes from spreading through the building. There is also a suction fan installed in the roof.

Equipment of the Arts Department

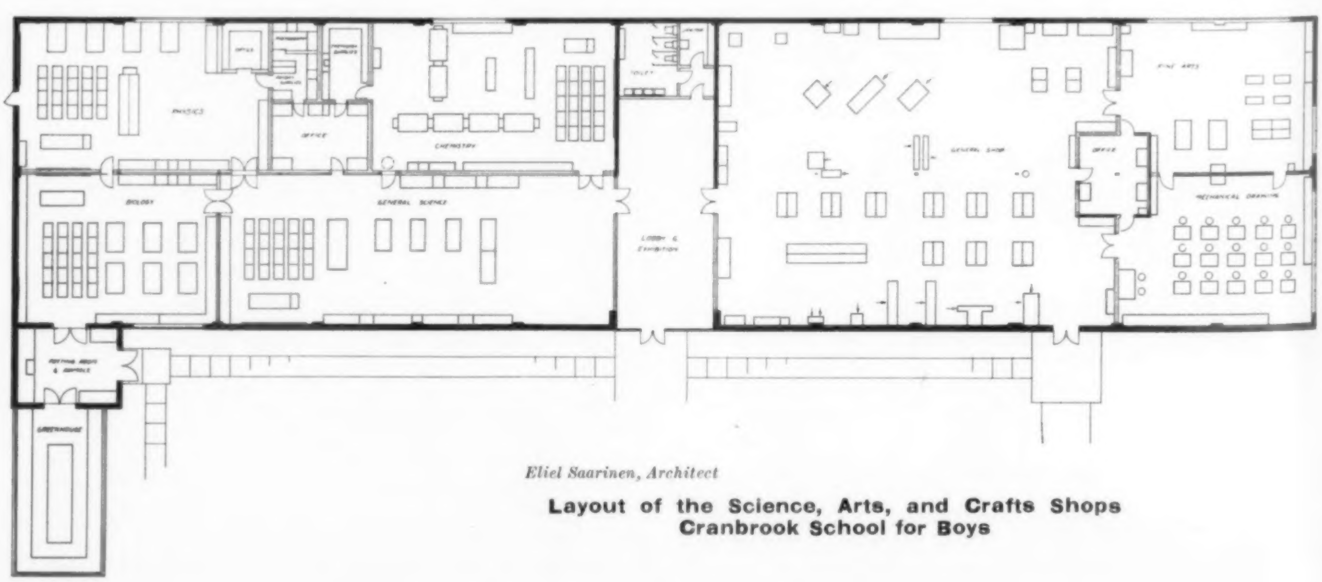
An attempt was made to arrange the equipment of the arts laboratories as depicted on the accompanying drawing.

Again, flexibility and supervision were the two main factors considered. A brief study of the lay-out sketch will indicate the grouping of the equipment.

View of Industrial Arts Shop from the Southeast Corner

(1) Bench and machine wood-working; bench and machine metal-working; foundry, forging, welding; ceramics; art-metal work, are all in the general shop. (2) Painting, sculpture, and the graphic arts classes are located in the northeast corner of the building in order to take advantage of the natural light. (3) The drafting room is standard in arrangement, but in this situation serves as a planning room for the entire department as well as a classroom for mechanical drawing and design.

A well-ordered flow of student traffic is accomplished by virtue of ample floor space and systematic arrangement of equipment. This is a factor of considerable value because of the type and diversity of offerings. The program is completely individualized. Each student selects, plans, and carries to completion his own problem according to his skill and maturity. In developing a program of this type, the problems of storage space and student work have been adequately met by providing wall-type storage cabinets for general supplies and individual lockers and drawers for student work. No central tool crib or stockroom was planned for this area, but in their place were installed



Eliel Saarinen, Architect

**Layout of the Science, Arts, and Crafts Shops
Cranbrook School for Boys**

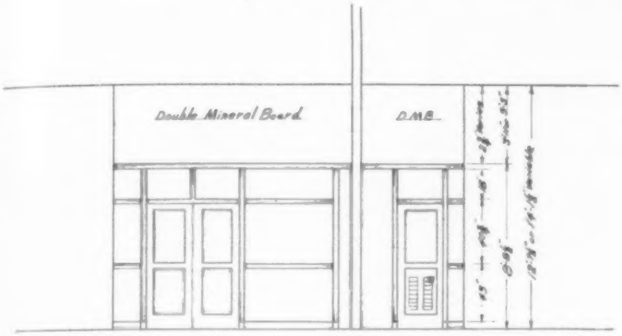


Fig. 2. Typical Elevation of Steel and Glass Partition

open-cabinet tool panels, lumber and bar-steel racks and a sheet metal storage cabinet. The ceramic clay is stored in earthenware crocks adjacent to the kick wheels.

Because books and magazines have a place in this type of work, adequate provision was made for book shelves in each laboratory adjacent to the office walls. There is space for approximately 200 books and periodicals.

Over a period of several months, this arrangement has proved satisfactory. Students find it a convenient and comfortable place in which to work; and the instructional staff enjoys the ease of supervision, the good acoustics, and the general spaciousness of the entire department.

Equipment of the Science Department

The broad objectives of the science department may be summarized as follows:

1. To develop in a student an appreciation and an awareness of the world about him and the contributions of applied science to society.
2. To develop technical skills in those students who demonstrate the ability and need.
3. To encourage utilization of the problem-solving approach and employment of the "scientific method" in the various fields.
4. To recognize that some students have the ability and desire to develop eventually into scientists or engineers. This recognition is to be followed up by personal encouragement and by providing every opportunity for each student to make the most of his abilities.

These objectives were kept in mind as the plans were made for the construction and arrangements of the science section of the building. For instance, space was made available for the inclusion of economics or those phases of the social sciences which most directly deal with an understanding of the impact of applied science on society. Corridors were eliminated in order to permit students to observe activities in other fields than the one in which they happen to be specializing in at the time. The "hall of technology" at the main entrance is intended to bring together contributions from the different fields in the building to a public place where all students would have an opportunity to observe their interrelationships. For this reason, also, the subject areas were so arranged that instructors in various fields can use other laboratories and equipment as they might be desired for specific class purposes. In the physics laboratory, for example, one section has been set aside for a demonstration laboratory where equipment is set up for use by interested students. The optics room and dark room are so situated that they may be used without interfering with physics classes. The potting room and greenhouse are near the general science and biology laboratories and are also available to students interested in various phases of biophysics or biochemistry. Advanced chemistry students use the chemistry laboratory while elementary classes are being held, the cases containing the reference materials providing a visual block between the two groups, but allowing the instructor to look over them and observe activities.

The laboratories are large enough to permit installation of equipment of an increasingly specialized nature as the need is felt. The chemistry laboratory contains flat-topped tables, 6 ft. by 3½ ft., provided with services at the ends and with sinks between. These allow a large free surface area. Under the center are three shelves for holding trays of equipment. After careful analysis, it was found that it would be less expensive for the school to stand the normal breakage than pay the equivalent interest on much more elaborate standard equipment provided with locks etc., the difference in cost being very considerable. Furthermore, it eliminates all the rigmarole of issuing keys and the necessary continual checking on the neatness of the usual standard equipment, much of which is rarely used.

Four flat-topped tables run lengthwise of the room, with a 5-ft. clearance from the wall cases. The other two are placed at right angles to this long row which leaves considerable free space in the center of the room which can be utilized in various ways. At present it is being used as a reference and study area, screened by an L-shaped arrangement of 4½-ft. book shelves.

The old Lincoln-type tables were broken into separate units and installed around the sides of the general science laboratory, leaving the center of that room free for other uses. A cabinet was constructed, with drawers that had been salvaged from discarded equipment.

The third and fourth objectives outlined indicate that a number of individual experiments are going on at the same time, and the scope of each depends upon individual ability and technical skill. Considerable space, therefore, is necessary in order to leave complicated apparatus set up, sometimes for long periods of time. Moreover, as the entire department is open to view from all angles students can work at any time with a minimum demand on personnel.

To sum up, the motive behind the construction and arrangement was to provide one large work-shop for optimum experiences in the science area, with auxiliary space provided for class meetings and for special functions.

FACILITIES FOR A DIVERSIFIED ART PROGRAM

By K. F. PERRY

Chairman, Division of the Arts, Colorado State College of Education, Greeley

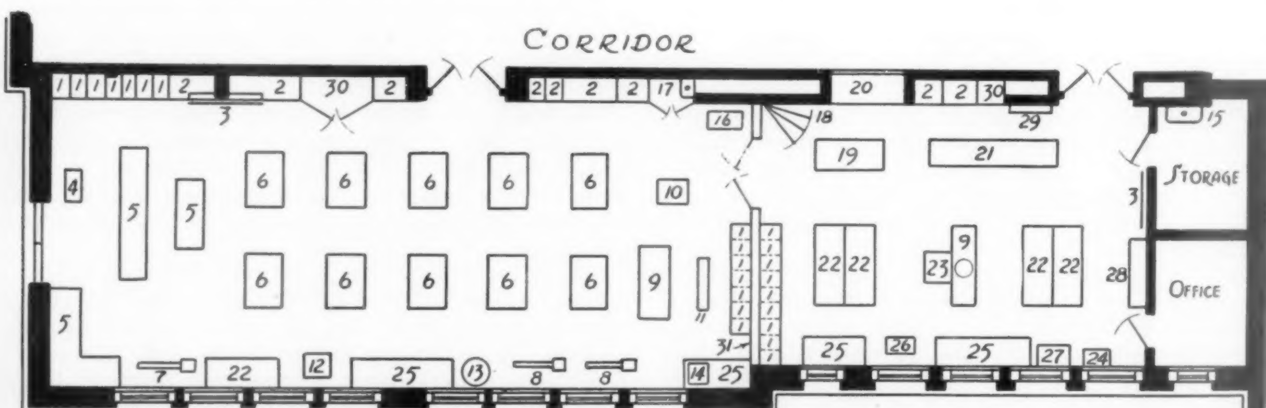
DOES increased opportunity for children to work at a variety of things in an arts laboratory make for loose teaching? Can the traditional barriers between the fine and industrial arts be broken down and all types of work be presented at the same time? Can one workshop be organized which will actually make possible the teaching of every kind of work from oil painting to metalwork? In addition to combining activities, can we also meet children of all ages, interests, and abilities at the same time? Can we successfully stop bells, and, where necessary or desirable, permit students to continue on problems for additional hours, days, weeks? These and dozens of other questions were asked when an experimental workshop was organized in the laboratory school of Colorado State College of Education, Greeley.

Need for Experimental Work in the Arts

Much has been written about the necessity for providing for children's needs, but little has been done to discover what those needs actually are. As the problem is studied, one is caught at once between the necessity for presenting what the teacher thinks should be taught, and providing *opportunity* for the student to do what he wants to do. Assuming the child's needs be real—coming as they do from the work of the whole school day—it is easy to understand how the average class in the arts can make only partial provision for their development.

All educational literature is full of pleas for recognition of individual differences, but once again the arts program in most schools is limited to a few opportunities for the individual student to pursue his interests and develop his abilities. If an occasional teacher does tend to expand the program and encourage individual work that deviates from traditional practice, he runs the chance of being called "progressive," as though there were some stigma attached to making provision for opportunity to work in an area of interest. Lest these remarks seem careless or be construed as a plea for shallow teaching, let it be said that any teacher in a creative field knows that original work is based on a solid background of skill in managing a material, together with a broad knowledge of what to use and when to use it. Creative work does not just happen. The metalworker, the sculptor, the painter, each craftsman and artist needs mastery of the medium and the broad background of previous experience in order to produce a superior result. The acquisition of this experience and background carries the student into many areas and it takes little imagination to see the contribution to his general education.

Assuming, then, that we as educators are genuinely interested in making provision for individual differences and that we do see the need for expanding the *opportunity to work*, we are at once confronted with the problems of method—*how* to do what we *want* to do. The experienced teacher of specialized work may ask how to teach basic lessons and skills and still be able to offer the chance for development of work



The Workshop After Remodeling

LEGEND

1 Student lockers
2 Storage lockers
3 Blackboards
4 Metal squaring shears
5 Metalworking table
6 Woodworking benches
7 Metal lathe
8 Wood lathe
9 Metal top glue table
10 8" saw
11 Jointer
12 Band saw
13 Drill press
14 Scroll saw
15 Sink
16 Lapidary
17 Sink and paint storage
18 Display racks 4' x 7'
19 Glass display case
20 Old shop door converted into glass display window
21 Flat top work table with leather and bookbinding storage built in
22 Flat top work tables, portable
23 Electric kiln
24 Bench shears
25 Work table and storage
26 Paper cutter
27 Clay bin
28 Book cases
29 Magazine rack
30 Tool cabinet
31 Glass partition between rooms

Sixth graders at work. Pupils have free choice of activity. The section of the room in which they work depends on what they do. The use of workbooks gives the activity organization and purpose

Fifth grade pupils busy with a variety of activities. Behind them is a swing display rack for the exhibit of pupils' work. Studies show that the crafts are the most popular activities

originating in other areas in the school. The administrator may ask what types of work should be included in a program he is starting, or how to expand a limited program which is already underway. As this article is being written, the principal of a school in a town of 30,000 writes in to ask whether work for girls should be different from that usually offered for boys. He is setting up a new class for girls and considers it quite an innovation to be able to offer it to them—but he has not yet come to the point of offering the opportunity for girls and boys to work together in the same class. If the ultimate goal is the general education of the child, why do we go out of our way to erect unnatural barriers that complicate rather than simplify teaching procedures?

Developing an Experimental Workshop

The experimental workshop as it was set up in Greeley proposed to do two things: (a) to determine the teaching problems involved when an effort is made to combine the arts in one laboratory and (b) to determine *what* children choose to do when all restrictions are removed and full opportunity is offered for participation in any type of work. Problems for specific study came as a result of interviews with several hundred teachers and school administrators.

The workshop itself was developed by removing a partition and enlarging the room previously devoted to woodworking. It made provision for every possible type of activity usually included in the industrial or fine arts departments of most schools. As teaching progressed it was not uncommon for a group of children to be engaged in as many as ten or twelve activities at the same time. Class size has ranged from twenty to eighty-three per hour with boys and girls, elementary and secondary school youngsters working together. This tends to sound "loose" as it is described here, but actually it calls for a high degree of organization; and one can readily sense the necessity for good preparation on the part of the teacher.

Recent study indicates that one of the reasons children turn from the arts to other interests has been the narrowness of their scope in the average school. It is true that teachers and schools have been handicapped by the lack of both money and room, for work in the arts demands materials, equipment, and space. It is equally true that teachers have been prone to be guided in their work by traditional practice, and have made little effort to spread activities in order to make provision for varying interests and needs of children. Indirectly they have fostered the idea that work could be done only in elaborate shops. The so-called "industrial" arts have tended to center activities around woodworking, metalwork and drafting; the "fine" arts emphasized painting, drawing, and design, with occasional work in ceramics and crafts. The work has been restricted further to the administrative limitations of class hours. Creative work related to the immediate problems of the child must be carried on within the confines of the minutes devoted to the arts as a school subject, which introduces the necessity of offering opportunity hours in addition to the regularly scheduled classes.

Because the teachers of specialized areas were later to criticize the work of the general program offered in the experimental laboratory we perhaps should ask ourselves how broad a program should be, and specifically what activities should be offered. Two opposing forces are active here—the specialist who wants to know "When are these children going to spend enough time on one type of work to learn to do it well?" and the educator-administrator who constantly asked, prior to the experiment, "when are you people in the arts going to break down and offer enough kinds of work to interest and serve all students?" One wants to produce an expert craftsman; the other is interested in the general education of the child. Both are right according to their own training; and somewhere, it was thought, there must be a middle ground where both purposes can be achieved—craftsmanship and broad experience. This does not mean that every student will be an expert as he leaves the workshop, but it does mean that in the general program craftsmanship also can be served.

Cutting across five years of experimental work for the moment—five years where anecdotal records were kept of all significant responses—we should recognize

No one worries when large and small pupils, boys and girls, work together. Although classes are held on schedule, pupils may come to the workshop when ever they have something to do. Pupils work at all activities at the same time

some significant incorrect concepts of the arts which must be faced as any attempt is made to organize an arts program. Important among these fallacious concepts are the following:

1. The "thing as end" concept.—The "thing" made is too often regarded as the sole end of the work. Teachers interested in the general education of the child know that the object constructed can disappear or be destroyed and the learner will still retain the values of the experience.

2. The "workshop provides nothing but activity" concept.—The notion prevails that a workshop is primarily a place of classroom *activity*—that very little is ever learned there. One classroom teacher remarked, upon observing a lesson in safety, "Why, I never realized that you ever *taught* these children anything down here."

3. The "workshop is the school service department" concept.—Closely related to the first two concepts is the belief that the shop is primarily a service department where repair work may be done for the whole school, or orders placed for everything from bookcases to posters and stage scenery. Assuming the needs to be real, the experimental workshop made provision for all types of work—and then worked with groups who came with a job to be done. *Orders* were refused, but pupils from other areas with problems to be developed were welcomed.

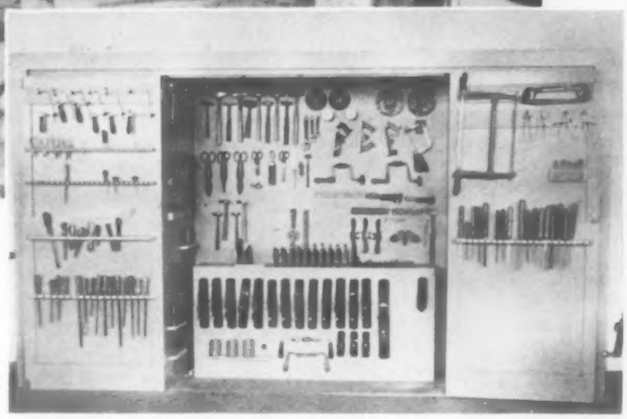
Seven other concepts, all equally incorrect, were listed as the work developed, but the three above are sufficient to indicate the fact that the presentation of an adequate arts program is not limited to the organization of the laboratory itself. A satisfactory program takes more than rooms, and a superior job of teaching can be done under very modest circumstances.

Workshop Need Not Be Elaborate

Probably at this point a few words should be said about money or the budget as it relates to the arts program. Those of us who have had occasion to work with experienced teachers are aware of the emphasis placed on elaborate laboratories and fine, modern equipment. Without discounting the desirability of ideal working conditions, this emphasis often leads the administrator to think that art activities can be conducted *only* in rooms containing hundreds or thousands of dollars worth of equipment. This point of view was reflected both in the interviews with administrators, made as part of the experiment, and in remarks made during their visits to the workshop itself. Many frankly stated that they would like to have an arts program in their school but that they could not afford it. They went on to explain that their budget would not permit the purchase of equipment necessary for a shop or laboratory. When told that work could be started on any ordinary flat-topped table or school desk, with inexpensive or borrowed tools, they smiled. Their beliefs are to be respected, though, because few of us in teacher education have ever done anything to indicate that *ideas* and *original thinking* count more than the elaborateness of the laboratory. All of us are too prone to see the fine, modern, expensive factories producing today's products—seldom do we see the modest circumstances in which the ideas behind those products were born. Many important inventions were brought forth in a basement or garage. Many of the world's finest creations were produced in a garret. These statements are not made as a plea to reduce workshops to bare rooms—rather they are presented to show that someone, somewhere, should dramatize poverty in a shop in order that educators can sense that an arts program can be had under *all* circumstances. Because of this need ten units of work were taught experimentally for a total outlay of **$101.20**. Many of the necessary pieces of equipment were made by the pupils themselves and all worked with as few tools as possible on ordinary flat-topped tables. The work produced was judged by qualified people to be the equivalent of that produced in the most modern shop.

Success under modest conditions tends to stimulate growth, especially in the smaller schools. A number of teachers have reported starting an arts program along with regular work, with tables in the corner of the room constituting the "shop." So successful were

Left—Large room, looking east from the glass partition. Woodworking benches were pushed together to make room for the portable easel holding the mural in process. The easel is taken apart and stored when not in use



Right—The tool cabinet is built into a space between walls that was originally used for the ventilating system. There are storage cabinets behind the open doors

Below—One of the hall doorways was converted into a glass display window. Exhibits are arranged by students in terms of seasonal interests. Storage cabinets were built in above and below the window. This is a view of the display case from the hall corridor

results that sufficient money was appropriated in succeeding years to run full programs. In one large junior high school in a city of 300,000 a young teacher demonstrated that a rather complete crafts program could be carried on with portable equipment in a regular classroom. He made a box about the size of an ordinary suitcase which housed all necessary tools and a small amount of the materials required. Other material he carried in rolls or packages under his arm as he came to the room. He carried on this program for a two-year period, with such success that one of the most "hard-boiled" principals in the system provided a modern laboratory for its continuance. These incidents are cited to indicate that a wide-awake, well-prepared, energetic teacher can fulfill the art needs of the school in spite of physical limitations.

Administrators generally tend to sponsor activities valuable to the school; and it has been found that they favor rather than frown upon the arts, in spite of the remarks of certain teachers to the contrary. Several hundred administrators, when interviewed, expressed a better than warm interest in art in their schools. For the most part they admitted that they knew little about it as a subject; but they saw its possibilities if instructors could somehow leave the traditional pattern of teaching and increase their offerings. This "spread of offering" criticism appeared over and over again, both as a suggestion for improvement in art instruction and as a criticism of current practice.

Certain Significant Outcomes

The experimental workshop as it is described here is not presented as the only method of answering the many questions asked as it was started, together with others which arose as the study progressed. Rather it is but one school's answer to these problems. Other adaptations could be made in other schools—yet the underlying philosophy could remain the same.

Once the newness has worn off there is no difficulty in combining boys and girls in the same class. Similarly, both large and small children can work together with more desirable than undesirable results. Certain older children take great pride in becoming instructors to the younger ones. The social implications of all kinds of natural grouping when pupils have both purpose and desire may readily be seen.

Large classes present no particular problem when students know what to do, how to proceed, and have a place to work. Lacking knowledge of how to proceed, or failure to find a place to work, causes discouragement and creates an instructional problem.

The pupils' enthusiasm in working entirely on the job at hand tended to exclude all other experiences

possible in the situation. The production of a "thing" alone was dominant. To bring in related materials and knowledge pertinent to the situation it was found necessary to develop workbooks. These are still in the experimental stage, but are answering the criticism of "hit-or-miss experience" and give direction to additional student effort. With the use of this workbook (one for each area of work), the teaching of basic skills can be carried on in the same class that offers opportunity for pupils from other areas to develop an individual or group project; it makes for organization and purpose beneath the atmosphere of informality.

What Pupils Chose To Do When Given Complete Freedom

Of the more than fifty activities offered, pupils tended to select woodworking oftener than any other type of work. The following list indicates the comparative popularity of activities. These figures represent the actual number of projects *completed* in each area during the time records were kept.

Bench woodwork	637	Water color	21
Leatherwork	187	Sheet metal	20
Loom weaving	132	Lettering	20
Art metal	120	Poster and Showcard	18
Wood turning	111	Bead work	16
Ceramics	81	Cartooning	13
Linoleum block	58	Plastics	13
Lapidary	44	Whittling	12
Charcoal drawing	42	Metal casting	12
Mechanical drawing	42	Upholstery	11
Pyrography	36	Raffia	11
Ornamental iron	35	Book crafts	10
Machine woodwork	30	Dress design	9
Bench metalwork	29	Alabaster	9
Oil painting	27	Puppetry	8
Wood carving	27	Tin-can work	8
Refinishing and repair	26	Celluloid "etching"	7
Book binding	25	Tie-dying	5
Metal turning	24	Metal spinning	5
Sketching	24	Batik	4
Blueprinting	22	Architectural drawing	4
Basketry	21	Design	3

There was little difference between the choices of boys and girls after the first few weeks. The above list indicates the popularity of the craft type of activity as compared with drawing and painting, and possibly points to activities to be included in any general program. That the crafts are the best-liked activities was also borne out in a paralleling study carried on among several hundred college freshmen in an art appreciation experiment.

Further Outcomes of the Study

In the light of teaching difficulties encountered, one or two suggestions should be presented here. Pupils must be kept within the range of their own ability to work. Spread of activity requires increased individual instruction, which means that a teacher has to work with as many students as possible during each class hour. Permitting students to select work too difficult for them causes discouragement or forces the teacher to do the work instead of the pupil.

The teacher should not encourage activities which he is unable to direct. It is easy to start with one or two activities and expand gradually. It is extremely difficult to start with a large number of activities and then attempt to restrict the work to one or two.

Expect more difficult rather than easier teaching when a free situation is encouraged. Teaching is far more interesting when all pupils are busy on work of their own choice, but it calls for definite organization and system.

An "orientation" course is suggested for all new pupils in order that they may sense the possibilities of the workshop.

A workbook is recommended to assist students in their own planning and to direct them into additional phases of the work they have selected.

The teacher himself must have a clear understanding of the purposes which his workshop can serve. He will be called upon to "educate" his fellow teachers as often as the members of his class. His opportunity to serve calls for a breadth of background and several areas of specialization.

The workshop itself is at one time a classroom where lessons are learned and skills are developed, and a laboratory of opportunity—a place where ideas can take form.

Author's Note.—The complete description of the workshop experiment is presented in detail in *An Experiment with a Diversified Art Program*, published by the Bureau of Publications, Teachers College, Columbia University.

KEEPING BUSINESS EDUCATION EQUIPMENT IN CONDITION FOR THE DURATION

By MAYE HYLTON

Training Specialist, Transportation Corps, War Department, Washington, D. C.*

PICTURE the bedlam that would result if all machine work in offices suddenly had to be done with pen and pencil. Such a picture is, of course, an exaggeration of any future state we may expect, but it shows clearly the importance of office equipment. Now that companies have suddenly switched from the manufacture of office machines to that of war equipment, and the government is diverting any new supplies and equipment to those businesses engaged in war work, we realize that our available equipment and supplies must be conserved.

Rapid turnover of office workers, another characteristic of the current period, inevitably results in extra wear and tear on office equipment. Persons responsible for business education in the schools should take steps to keep the present school inventory in its best possible condition, and, at the same time, to do a good job of training future office workers in practical methods of caring for equipment they will handle for employers.

Policies Regarding Maintenance

The progress and output of both students and workers are greatly affected by the condition of the equipment and machinery with which they work. Business education equipment that is to be used by many different types of students, working perhaps under several different instructors, can be properly maintained only when effective policies are established regarding its care. These policies should not be a series of rules and regulations arbitrarily set up by the principal or chairman, but must have the wholehearted backing of all teachers, students, and other persons who use the equipment for office work.

No one set of policies can be developed to fit all school training departments or all offices, but the following are representative points about which decisions must be made:

1. Keeping complete records of all equipment—purchase, repairs, and use.
2. Providing for contract maintenance, self-maintenance, or both.
3. Systematic cleaning and oiling of equipment.
4. Placing and storing of machines.
5. Teaching the care of equipment.
6. Determining standards for different machines.
7. Determining methods of attaining such standards.

Organization for Executing Maintenance Policies

Proper care of office machines and equipment, in the final analysis, is largely a matter of supervision. Instructions and regulations may have little or no effect unless provision is made for checking on individual and departmental compliance. The administration of any maintenance program should be assigned to one person in the department, in recognition of the fact that "everybody's job is nobody's job." Departmental instructors may elect as a supervisor of equipment some person who is mechanically inclined, who knows and understands the uses of such equipment, and who is interested enough in its upkeep to assume responsibility for executing a conservation program. If necessary, that person's teaching load might be reduced, for his duties would include:

1. Keeping a complete set of records giving purchase dates, make, source, cost price, serial number, and the nature and cost of repairs.
2. Investigating, requesting, and checking all service calls.
3. Checking on classroom furniture and on how individual classes leave room and equipment.
4. Comparing durability of different makes of machines so recommendations can be made if future trade-ins or purchases are possible.
5. Rehabilitating old equipment previously retired from service as obsolete or uneconomical.

Each individual teacher in charge of an office machine class automatically acts as an assistant supervisor of equipment by assuming these duties:

1. Helping each student to realize his responsibility for the conservation of machines by enlightening him as to its original cost, its present value, and the difficulties of replacement.
2. Giving clear, thorough, and well-planned instructions *before* the student starts to operate a machine; and teaching desirable short-cuts so the machine's highest degree of proficiency can be obtained.
3. Instructing each student in making minor repairs (for example, the ribbon mechanism of the typewriter deserves detailed instruction).
4. Making certain that each student cleans and oils every type of machine (as recommended by the manufacturer) at least once.
5. Insisting that machines be properly covered and stored after use.
6. Checking on monitors who issue supplies.
7. Reporting needed repairs immediately to the chief supervisor.

Each student likewise should realize that eventually he will be directly responsible for prolonging the life of any machine he may use in an office. Therefore, he should read instruction booklets on the care and operation of machines, learn parts by their technical names so he can discuss needed repairs in an intelligent manner, and develop as high a degree of operative skill as possible.

If business education equipment is used by the office staff, those workers should also cooperate in

* This article was written while Doctor Hylton was Instructor in Secretarial Studies at the New York University School of Commerce, Accounts, and Finance.

using machines properly and in keeping them in the best possible working condition.

Care of Different Types of Equipment

Several groups of equipment require intelligent servicing to keep them in first-class condition. As war demands upon manpower become greater, fewer service people will be available. Cleanliness of office space becomes an individual problem when janitor service is restricted. Get students to throw discarded paper into the wastebasket rather than on the floor. Show them how to prepare material for salvage.

Monthly cleaning services of machines may be restricted as workers are called for war duties; the operators will become responsible for the cleaning and maintenance previously performed by profession servive-men. Schools in outlying territories have long been giving instruction on the mechanical upkeep of office machinery which would have seemed a useless waste of instruction in a metropolitan center, where office machines have generally been "on service" and an expert mechanic could be summoned in a short time.

Wood desks and chairs, when new, should be waxed and polished. Daily dusting is usually quite sufficient, except for one periodic cleaning each term when each desk should be scrubbed, waxed, and polished. Lukewarm water and a mild soap will not injure paint if it is thoroughly dried off, but alcohol and harsh abrasives will ruin the finish. Insides of desks and cases should be thoroughly cleaned, useless material discarded, and the remaining contents and papers reorganized. A clean desk builds up real pride in maintaining a pleasant place at which to work. Special linoleum tops are very desirable and extend the life of a wood desk. If adding machines, comptometers, and similar equipment must be placed on a polished surface, felt pads should be provided to prevent scarring. Skilful use of sandpaper and a few coats of varnish will remove splinters, stains, and scratches from wood desks and chairs. Any school department can provide facilities for taking care of such wooden equipment.

Steel equipment, such as safes and files of all sorts (correspondence, invoice, visible, transfer, etc.) needs little attention except cleaning and polishing at periodic intervals, and protecting flat surfaces, as far as possible, from scratches.

Office machines, whether manually or electrically operated, constitute by far the most important maintenance problems so far as business education equipment is concerned. Most of the equipment now on hand must be made to last for the "duration." Some replacement parts are already becoming difficult to buy and we can expect further trouble in procuring them. If equipment is to be kept in condition, a periodic schedule for checking, cleaning, and oiling all machines is imperative; for only in this manner can wear be reduced and repairs held to a minimum. Often a minor adjustment saves major repairs later.

Care of Typewriters.—Typewriters will be considered first because they usually constitute a large investment. Typewriters used for educational purposes have been ordinarily traded in at the end of three years. Now, however, regular school exchanges will no longer be possible; and instruction will have to be continued on machines manufactured more than three years ago. Educators must restrict training to those pupils who will actually use typing in a vocation. Typing classes in junior high schools and in freshmen and sophomore years in regular high schools may be eliminated.

The number and seriousness of typewriter repairs, and consequently the number of service calls, can be reduced if each advanced typing student is required at specified intervals to hand in a half-page of typing from his machine. Included on the sheet should be the student's name, the serial number of the machine, and a statement of its condition with a description of any technical faults. Such a report gives the teacher a check on whether or not each student knows the correct name, location, and use of the operative parts of the machine, and facilitates general servicing of all machines at one time. Of course, all complaints must be thoroughly investigated before the serviceman is called. If the same serviceman can respond to all calls, a friendly and cooperative relationship can be built up; and the serviceman can often furnish enlightening details for a maintenance program.

Each typist should be made to realize his importance as a cog in the wheel of maintenance. The following general rules should receive special emphasis:

Daily Care

1. Dust machine with a soft-bristle brush.
2. Wipe carriage rails or tracks with a soft, dry cloth.
3. Clean slots in type bar segment, wiping toward the operator, first with a dry cloth, then with a brush to remove erasure dirt.
4. Clean type with a stiff brush, again brushing straight with the type bars to prevent their being thrown out of alignment. Such a daily dusting practically eliminates any necessity for the use of gasoline or alcohol on the type.
5. Release paper feed rolls during the day when not typing, and always at night. This prevents flat spots from developing on the feed rolls.

Weekly Care

1. Roughen the platen and feed rolls by washing them with a cloth *slightly* moistened with alcohol.
2. Wipe carriage rails or tracks with a cloth *slightly* moistened with a little oil.
3. Clean type thoroughly with a stiff brush, then wipe with a cloth moistened in alcohol, held over the finger. Alcohol should be used sparingly; it softens the type. Do not use a brush dipped in alcohol, for it sprays the fluid on the typewriter and desk, where it injures the paint.

Changing a Ribbon

1. Take ribbon off carefully to avoid bending vibrator.
2. Use ribbons manufactured for the model of machine used; spools that do not fit properly cause mechanical trouble.
3. Fit new spools properly into place and save old spools for reuse if necessary.
4. Make certain the ribbon winds in the proper direction so that the reversing mechanism can operate.
5. Thread the ribbon guide properly, being careful not to bend it.
6. Turn the ribbon over at least twice a week to lengthen its life and improve the appearance of typewritten work. Do not use the mechanism designed for two-color ribbon, because the ribbon guide must then travel a longer distance, slowing the action of the machine.
7. Eliminate many unnecessary service calls by gaining a better understanding of the ribbon mechanism and passing this knowledge on to students.

Cleaning a Typewriter

1. Begin cleaning at top of machine and work downward.
2. Move marginal stops to extreme ends of scale and clean wayrods as far as they can be reached with a cloth dampened with alcohol or type cleaner. Dust the entire section with a long-handled brush.

3. Depress all keys gently in order to raise the type bars enough that a brush can be used underneath them.
4. If type is to be cleaned with alcohol or a prepared type cleaner, cover the keyboard with a sheet of paper held in position by folding it over the top row of keys. Draw the swab straight with the type bars. Use the swab that comes in a bottle of type cleaner or a similar one of felt; a stiff brush or a pin is likely to chip the type.
5. Clean desk under typewriter; air currents sweep dust up into a machine. If machine is fastened to desk, place cloth over a ruler or long-handled brush and dust thoroughly; then slip paper under machine to catch the dirt and change paper daily.

Oiling a Typewriter

1. Very few parts need oil. If it is applied to the wrong parts, sluggishness results as soon as the oil hardens. Consult a serviceman if machine seems sluggish and needs complete oiling.
2. Regular typewriter or sperm oil is best, but any light machine oil may be used.
3. Use a touch oiler to keep moving parts of the machine lubricated. Apply oil sparingly and wipe off all excess, because exposed oil soon becomes sticky, collects dust and dirt, and may smear typewritten work.
4. Move carriage far to one side and place a drop of oil on wayrod; then move carriage to other side and repeat oiling operation. Depress carriage release lever and run carriage back and forth a few times to distribute the lubricant.
5. Never apply oil to the segment from which the type bars pivot, for it soon becomes gummy and slows down the entire machine.
6. All rubber parts should be protected. Oil deteriorates rubber.

General

1. Keep machine covered whenever it is not in use.
2. Report minor defects at once.
3. Grasp machine at bottom to move it—never by the carriage.
4. Avoid pounding. Many typewriter troubles are caused by a heavy touch which batters type, makes punctured copies, and causes needless wear on ribbons and platen.
5. Do not jerk paper from a machine but use the cylinder knobs for removing work. This prevents the cylinder from wearing so smooth that the paper slips. Such yanking also wears out the rubber paper feed rollers and paper releases.
6. Clear the tabular rack from left to right; otherwise, the tabular bars may be bent.
7. Do not set a typewriter near an open window, where it may rust, or too close to a hot radiator, where rubber and ink may deteriorate.
8. Paper clips, erasers, small pencils, loose tabular keys, and other small items, if accidentally dropped into the machine, should be carefully and immediately removed with a magnetized screw driver.
9. Make erasures outside the type bars by moving the carriage to the right or left of the type segment. Erasings will then not fall into the machine and cause such troubles as slow-action bars, sticking, poor alignment, and "piling."
10. Removal and proper replacement of a carriage, and adjustment of a tension band, can be learned by any teacher and often proves advantageous in keeping machines in working condition. More difficult adjustments, in most cases, should be left for an experienced repairman.
11. Keep up to date regarding types of services offered by the companies whose machines are being used. One company now offers three different service plans depending upon the age of the machines, all of which are guaranteed.

Care of Duplicating Machines.—Service departments are maintained on a cost basis by the manufacturers of these expensive machines, in order to insure production at peak service. With reasonably good care, however, few major repairs will be necessary if provision is made for a thorough yearly or semi-yearly inspection and general adjustment. Regular inspections should be made by an expert who is specially trained, who knows every spot to oil and who has the necessary equipment to do the job.

Care of duplicating machines may be broken down into four generalizations—cleaning, lubricating, adjustment, and supervision.

Cleaning and Inking

1. Keep machine clean and free from dust and paper lint.
2. A properly prepared stencil will eliminate an excess flow of ink. Type should be cleaned before starting a stencil, and an even touch should be employed so the flow of ink through perforations will be uniform. Corrections should be carefully made according to instructions for the same reason.
3. Never fill the ink reservoir so that the level of the ink is above the "full" mark on the ink measuring rod, measuring only after the cylinder has been in the "Stop Here" position for two minutes. The flow of ink is retarded by low temperatures.
4. The cloth ink pad should be changed often enough to insure a free flow of ink—approximately every thirty days. The life of the pad may be prolonged by agitating it each day before using—done by raising the pad by the bottom end and re-laying it on the cylinder so that all holes in the perforated diaphragm are covered.
5. To avoid ink seepage, cloth ink pad must be stretched taut over perforated diaphragm of the cylinder. This is accomplished by inserting lower part of pad end strip under the rod, prying pad taut, and hooking.
6. Remove the impression roller if it becomes badly soiled and wash with soap and warm water. (A plastic roller should, of course, never be cleaned with alcohol.) Dry thoroughly and run a sheet of paper dusted with ordinary talcum powder through machine to eliminate stickiness.

Lubrication

1. Oil bearings and other places where friction occurs, using a lubricating oil of medium weight.
2. Renew supply in both central oiling systems regularly once a week.
3. Study chart in instruction book which tells just what to oil, how much, and how often. A very small quantity of oil should be used at all points not already equipped with oil bushings.

Adjustments

Complete detailed instructions are given, both in the instruction book which accompanies the machine and on the package of stencil sheets.

Supervision

1. In order to save time and paper, "gang up" the jobs; i.e., plan to do all card jobs at one session, all letter-size jobs at another, and all legal-size jobs at another, in order to eliminate unnecessary and time-consuming machine adjustments.
2. Run the first copy at a very slow rate of speed, to save time and paper by making adjustments on one test copy.
3. Set indicator so paper will not be wasted on superfluous copies.
4. Do not run the machine at top speed, for this will shorten its life.
5. Always keep cylinder in "Stop Here" position when not in use.
6. Never leave a stencil on overnight, but clean it thoroughly if it is to be saved. Attach the flexible protective cover to the duplicator and run several sheets of paper through to bring the impression roller into contact with the cover and seal it thoroughly at all points.
7. Clean thoroughly both before and after using. Dust and grit are enemies of the machine.
8. Apply the brake if a machine has one.
9. Disengage the electric mechanism.
10. Leave adjustments in the middle (the standard 8½ by 11 position) merely as a courtesy to the next user of the machine, and in neutral in order to remove all unnecessary tension.
11. Keep machines entirely covered and all doors tightly closed.

Care of Dictating Machines.—The manufacturers of these machines publish material which gives detailed instructions for the operation and care of their

machines. They provide charts showing what should be cleaned, what should be oiled, how much, and how frequently.

Heed these special recommendations:

1. Do not use benzine on the machine. When it is combined with wax, a gummy substance results.
2. Shut off the motor when the machine is not in use.
3. Hang up the mouthpiece gently in order to prevent chipping.
4. Take care of practice records and clean them carefully in order to eliminate surface noises caused by accumulations of dust.
5. Examine machine cords frequently. Plug cords into outlets with care.
6. Sterilize the mouthpiece of the dictating machine. This is merely a precautionary measure when numerous persons are using the equipment.
7. Have machines inspected periodically by an expert serviceman.
8. Make use of all education aids furnished free of charge by the companies—error charts, record charts, achievement records, personality charts, and the like.
9. Dust all parts of the equipment daily and keep them thoroughly clean.

Care of Adding and Calculating Machines.—As these various machines have enclosed parts, their manufacturers recommend that their representatives keep this equipment under maintenance inspection. Periodic overhauling can be made when necessary. Such maintenance service insures replacement of all worn or broken parts with new parts manufactured for that company's machines. The cost of such service differs with the type of machine, and insures uninterrupted use of the equipment.

1. Dust the exterior of the machine with a soft cloth and wipe it with mineral oil.
2. Pull out the electric cord when the machine is not in use.
3. Use paper that is put out or recommended by the manufacturer of a listing machine; other papers may damage the mechanism.
4. Take precautions in placing portable machines on a desk or stand for use; if set too close to the edge, they may be brushed to the floor and broken.
5. Keep paper clips, hair pins, pencil leads, and such miscellaneous items in a position that they cannot drop into the mechanism.
6. Don't pick up machine by carriage.
7. Don't use nail polish remover near an electric machine where the inflammable fluid may be ignited.
8. Do not attempt to oil or adjust the machine.
9. Cover all machines when not in use.

Conclusion

Any course in typewriting or the use of office machines should now include a special section of study and practice in the care of such equipment. Most of this instruction can be given by the regular teacher, but more complicated points may well be left to the supervisor and the company's maintenance specialist. Most office equipment manufacturers have provided excellent literature describing their equipment and its proper use and care. These directions are frequently supplemented with diagrams, oiling charts, and other objective aids. Most of this material can be used effectively for training purposes. Unfortunately, such type of material is not available for all types and makes of office machines.

At least one teacher-training department in a university is now offering a special course dealing with the care and maintenance of office equipment. Such a step is undoubtedly one in the right direction. Plans must be laid for a long time to come because the present emergency is likely to continue long after the end of the war.

GETTING MAXIMUM USE OF AUDIO-VISUAL MATERIALS

By MARY EMILE WINDLE

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ONE of the educator's problems is that of discovering the most effective ways to improve the quality of educational experiences—to increase their breadth and depth. Unquestionably the comparatively recent departure from the confines of verbal education is the greatest single progressive step toward enriching the quality of experiences and expediting learning. Sound and silent films, radio programs, recordings, film strips, slides, objects, specimens, maps, pictures, and stereopticons—all of these constitute audio-visual equipment which vitalize the educational program. Their instructional value is in direct ratio to the effectiveness with which they become an integral part of the school experiences planned *by*, *for*, and *with* the total school personnel. The educational potentialities of the materials should be the first point for consideration when making selections.

The function of audio-visual instructional materials may be regarded as that of vitalizing teaching and of facilitating learning. Teaching power is increased and pupil concepts are greatly expanded as a result of proper utilization of these aids. It is highly essential that the teacher have an awareness of the singular contributions which *all* types of the materials make to the educational program, if and when their integration with the controlled school experiences is a natural one.

Some Practical Recommendations

Many states' higher institutions and smaller units are expanding their audio-visual departments. In a bulletin to the teachers of Virginia,* the State Superintendent of Public Instruction has this to say:

> ***Why Use Audio-Visual Materials?***—Answers to the frequently asked question, "Why should I use audio-visual materials?" have usually taken the form of statements drawn from everyday teaching experience or conclusions stated on the basis of controlled experimentation designed to show the superiority of learning accomplished by students with whom audio-visual aids are used as opposed to those taught by more traditional methods. Without attempting to make of them panaceas for educational ills in general, the values listed below are those upon which teachers in general are agreed.
>
> ***Values for the Student.***—Audio-visual materials have been found to be valuable adjuncts to the teaching process for a number of reasons. For example, teachers have found that they increase teaching efficiency by:
>
> (a) *making learning more realistic and concrete.* Learning based solely upon written materials often encourages the development of verbalisms and parrot-like repetitions of ideas which are as yet unassimilated by students. Motion pictures, slides, school journeys, or recordings may facilitate a presentation of the same ideas and concepts in a more realistic, concrete manner which enables them to be interpreted and understood with a minimum dependence upon language and reading skills.
>
> (b) *speeding up the learning process.* It has been found, for example, that it is possible to present certain aspects of the curriculum at an earlier level when motion pictures are used. Certain educational experiences may be presented realistically by means of motion pictures which would require more time if they were to be experienced in actual life. Plant growth, for example, is a phenomenon requiring several weeks or months to observe completely. On the other hand, the educational film, PLANT GROWTH, makes use of stop-motion close-up photography to present three weeks' growth in a space of ten minutes and causes seemingly static plant growth to become an action of twisting, turning motion full of interest to all students.
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> (c) *presenting striking, new information in an interesting, thought-provoking manner.* Exposure to disconcerting social facts through the medium of slides, school journeys, motion pictures, or recordings may often lead students to make clear statements of problems and to encourage an investigation of them further in small work groups. There is often a lag between social and scientific discoveries of note and their appearance in print. Many times, such discoveries may be popularized quickly by means of educational motion pictures.
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> (d) *overcoming limitations to learning.* The student who cannot read well or who is afflicted by impaired hearing faces a distinct disadvantage in the schools. Certain audio-visual materials overcome such limitations by presenting ideas in a new picture language. Additional limitations of distance (trips to foreign countries), time (studying events which happened in the past), danger (observing intricate processes inside a Diesel engine), cost (studying the technique of measuring earth tremors by means of a seismograph), or others may be overcome partially by the use of appropriate audio-visual materials which *reproduce* the situations in a manner which simulates the real experience.
>
> (e) *cutting across subject matter lines and encouraging integration.* It is difficult, for example, to make a school journey solely for the purpose of studying science. Objects and situations observed on school journeys, in motion pictures, or slide sets are inescapably related to the environment in which they are situated. They become real life experiences which enable the student to see relationships between all spheres of human activity.
>
> (f) *emotionalizing and dramatizing certain experiences.* Recorded dramatizations and motion pictures are excellent media for presenting certain vivid experiences which, because of the emotionalized treatment, become means of developing worthwhile attitudes and appreciations. A dramatized treatment of the life of Walter Reed as recorded from the CAVALCADE OF AMERICA series, for example, offers an opportunity to provide students with an interesting, vivid experience from which may be drawn generalizations concerning strength of character, devotion to duty, personal honesty, courage, and the significance of the scientific method. Again, the motion picture, SONG OF A NATION, enables the student to visualize circumstances under which the National Anthem was written and to sing it with new fervor and with new appreciation of its meaning and significance.
>
> (g) *developing and improving skills.* School journeys provide opportunities for the students to develop skills in the art of thorough observation of elements in the environment. Slide units dealing with life in foreign countries become devices from which students may receive training in drawing out information and doing geographical thinking. Certain motion pictures, likewise, have been produced especially for the purpose of training students to *do* things and to improve certain skills. There are, for example, films dealing with the art of pottery making, hog raising, music appreciation, broad stroke drawing, swimming, or making marionettes.
>
> (h) *developing responsibility and cooperation.* Student responsibility and class cooperation are often fostered in the class which, with guidance from the teacher, makes most of the arrangements for making a local school journey or which

* *Instructional Materials for Virginia Public Schools.* Richmond, Va.: State Board of Education, July, 1942, Volume 25.

is concerned with the selection and projection of audio-visual materials in the classroom. Cooperative group projects growing out of experiences gained through audio-visual means often develop an increased spirit of friendliness and cooperation among the students.

Values for the Teachers.—Audio-visual materials are not alone of value for the student. As a result of a recent questionnaire sent to the 300 schools using the state audio-visual service during 1941-42, it was found that teachers using the materials found them valuable in:

(a) *building stronger community relationships.* The teacher who takes her class on occasional trips to provide first-hand experience with significant aspects of community life, who encourages the students to bring to the schoolroom specimens and objects found in the environs, who attempts to interpret a part of the community's life through student-and-teacher-made pictures, and who frequently invites to her school members of the community whose travel experiences or collections are of interest to her students not only enriches her teaching, but at the same time draws the school and the community into closer relationship. Likewise, the school which makes available its motion picture projector to the civilian defense coordinator, the director of the local cancer drive, or a local local church group is helping the school and the community to realize common objectives.

(b) *encouraging a greater degree of planning.* Because it is often necessary to plan for the use of audio-visual materials several weeks in advance of the time they are to be used in their classes and because careful planning is necessary if the use of the materials is to be at all satisfactory, teachers often feel the experience thus gained is as valuable for themselves as for their students.

(c) *saving time and energy.* Motion pictures, for example, are used to review large units of work in a short space of time. Certain misconceptions may be cleared up by repeated showings to those members of the class having difficulty.

(d) *stimulating new enthusiasm for teaching.* Some teachers who have taught the same subject for years and have come to feel that there is little new material in it realize that certain motion pictures dealing with that area of the curriculum are capable of presenting new information in such a way as to build a new appreciation of the subject's significance. One said, "Using films in this subject was a refreshing experience for both the students and me."

(e) *encouraging creativity and productivity.* Persons who find teaching more interesting when using some of the newer audio-visual materials are often encouraged to experiment with them in finding most satisfactory methods or in making new approaches to teaching problems. Teachers who find pleasure in making their own pictures have produced a series of still pictures or miniature slides which are valuable to themselves and to others in the school.

Sources of Various Types of Audio-Visual Materials.—Although the term "audio-visual education" has sometimes been interpreted as meaning solely the use of educational motion pictures for teaching purposes, there are, in reality, a number of materials which fall in this category and which are capable of adding to teaching effectiveness. It is the purpose of this section to describe briefly characteristics of the most common types of audio-visual materials, to suggest the nature of their potential educational contributions, and to enumerate reliable sources of materials other than those described in this catalog.

The School Administrator.—The school administrator who is interested in having the use of audio-visual materials in his school become something more than a fad or a source of occasional student entertainment:

1. recognizes the need for making financial provision for purchasing necessary audio-visual aids and materials and regards good maps, charts, models, still pictures, motion pictures, or slides as essential teaching devices rather than as "frills";
2. delegates primary responsibility for systematizing the use of audio-visual materials within his school to the teachers and encourages the formation of an "Audio-Visual Committee" of teachers, including the librarian;
3. appoints one member of the committee, preferably the librarian, to serve as the school's *audio-visual representative* whose duties are suggested below.

The Audio-Visual Representative.—Within each school it is suggested that one member of the faculty, preferably the librarian, be given the responsibility for developing a systematic and workable scheme for utilizing various types of audio-visual materials. Working in close cooperation with the teacher committee mentioned above, the audio-visual representative:

1. becomes acquainted with and calls to the attention of other teachers educational resources within the local community which can be exploited by means of school journeys or other means;
2. keeps abreast of new developments in audio-visual teaching materials by reading reviews in journals, summer schools, and by other means;
3. handles all correspondence necessary in booking and using materials in his school and becomes thoroughly familiar with the offerings listed in this bulletin;
4. works with individual teachers in suggesting audio-visual materials which could be utilized to advantage in their classes and helps them to develop skill and confidence in using them;
5. organizes, trains, and applies for licenses for a squad of student projectionists whose duties are those of arranging for the showing of films and slides, maintaining equipment in good condition, making minor repairs to films, and returning materials to proper sources;
6. keeps records and evaluations of all audio-visual materials used in his school which may be referred to in the future. (The reverse side of the 1942-43 "Confirmation of Booking" contains space for these records.);
7. arranges schedules for the use of certain materials requiring equipment, thus avoiding confusion and disappointments;
8. discourages indiscriminate use of audio-visual materials for frequent auditorium showings and endeavors to help teachers make them a natural part of classroom teaching procedure.

The Individual Teacher.—Upon the classroom teacher is placed the final responsibility for efficiently using audio-visual materials in the classroom. Without serious effort on her part, such materials become little more than "under-exposures" which could have turned out brilliantly had care been exercised. The individual teacher interested in obtaining the largest educational returns on the time invested:

1. attempts to become familiar with as many audio-visual materials as possible to find those which would be the most applicable to her teaching needs;
2. uses this catalog to assist her in finding the *specific* materials she wants for the particular problem she has in mind and orders through her audio-visual representative only those which will affect the problem directly;
3. refrains from using audio-visual materials merely as a means of filling in time, entertaining, or providing relief from classroom tedium;
4. previews all audio-visual materials *before* they are used with her classes in order to obtain necessary information concerning their content and so that she may adapt them to the work of her class at the time;
5. uses audio-visual materials with her classes only after the class is aware of specific *purposes* for seeing or hearing them and usually attempts to have the students state these purposes in question form so that they are understood by and become the aims of all;
6. makes an effort to ascertain the extent to which original purposes were satisfied by the use of the audio-visual materials immediately following their use, whether by class discussion, an oral test, or a written "check-test";
7. takes advantage of significant questions and problems raised by the materials to encourage students to do additional study in the area or to express themselves by other means;
8. allows students to assume some of the responsibility for selecting, evaluating, and planning the use of audio-visual materials in the classroom and in helping her organize and maintain a suitable file of illustrations, maps, and other useful materials;
9. works closely with the school's audio-visual representative when looking for audio-visual materials which will fill her needs.

The Student.—The student in the school which uses audio-visual materials has increased opportunity to learn more about the world he lives in, to see relationships, and to understand processes which would be more difficult to visualize without them. Such a student:

1. realizes that audio-visual materials are more than mere entertainment devices and that they provide a means of presenting difficult concepts with clarity;

2. approaches a motion picture, a set of slides, or a transcription with a serious learning attitude and with specific questions in mind, the answers to which he hopes to find in the materials;
3. exercises critical judgment of the materials he sees or hears, and feels free to challenge the authenticity or accuracy of the facts presented;
4. sometimes serves on student committees whose responsibilities are those of selecting audio-visual materials, arranging school journeys, or setting up exhibits;
5. sometimes uses hand-made lantern slides, graphs, charts, still pictures, or motion pictures in the presentation of reports to the rest of the class, realizing that there are certain advantages in expressing his ideas concretely.

The Student Operator.—The student operator is often able to assume much of the responsibility for the care and operation of audio-visual equipment and at the same time to indulge and improve a natural interest in electrical and mechanical devices. Students adjudged competent by school's audio-visual representative or principal may be licensed to operate equipment in which audio-visual materials owned by the State Board of Education are used. The student operator:

1. knows how to assemble projection equipment, connect it to the power supply, make all necessary adjustments, and (if a projector) position it for screen size;
2. knows how to clean all optical equipment, oil necessary parts, and adjust all controls for maximum quality and clarity;
3. knows how to thread and focus motion picture projectors, frame the image on the screen, inspect film for possible damage while it is in operation (by touching film lightly before it passes onto the take-up reel), and rewind films on the machine;
4. handles all films, slides, and records carefully to avoid damage; keeps them away from fire and heat; repacks them in proper containers; and correctly addresses all return shipments.

Instructional Films Do a Good Job

Surveys reveal that a great majority of the larger audio-visual centers in state departments of education, in cities, regional centers and in smaller school units have equipped their materials departments with more of the sound films than with any other photographic aid. The federal government is making wide use of it in all of the training areas, and in the promotion of understanding between nations. Therefore, it seems fitting that some consideration be given to utilization of instructional films. All that is presented herein is a product of practical experience which the writer has had as supervisor in the Danville city schools, as a research worker, and as a participant in the Virginia curriculum development programs.

An evaluation of films in terms of their contributions in the Danville program of instruction follows.

The Teaching Procedure Is Being Improved

Films lead to more careful planning. When making plans for learning situations within a unit of work, the teacher may re-review certain instructional films to discover possible relationships to the program and to a get a comprehensive picture of the content and its implications. Points for emphasis are determined. Possible concepts are formulated and questions are planned on the basis of expected understandings. Possible correlations are noted. Possible related activities are also noted. It is determined whether the film is to be used to introduce a unit, to further clarify some situation, to review a subject, or to do all three.

In addition to plans for herself, the teacher also has the children in mind. When a film is to be used, the children know why they are seeing it and some specific things for which they are to look. They are aware that they may ask any questions, participate in a follow-up discussion, see the picture or some particular scene again and again if needed; and that they are expected to seek further clarification of ideas or information through other media. There are more requests from teachers for help in planning specifically for the development of understandings than there were before the advent of visual aids.

Instructional films are further releasing the teacher from the limitations of traditional materials. Most teachers refer to the value of films in terms of "realism"—as something to strengthen vicarious experiences. The world is brought into the classroom. The limitations of verbal education are overcome.

Instructional films are inspiring the teacher to do a more creative job. There is definitely an increase in the collection of printed and pictorial materials. More museums are being developed. Beautification of grounds along a planned program are in evidence. Colored moving pictures have been made of local wild flowers, local industries, local forms of architecture and of school activities. (The flowers were done in connection with units of work on conservation.) Local industries were photographed when a fifth grade studied Danville and its industries. Pictures of types of architecture were taken while the children were developing the concept that architecture is an expression of the temperament of peoples. Pictures of school activities are kept for references.

Instructional films are reducing the drudgery of teaching. One teacher reported, "We covered more subject matter in a shorter period of time." This statement applies, of course, to purely explanatory content which ordinarily would be covered through discourse by the teacher or through reading by the children. Organization of content is made easier. *Drill, explanations* and *remedial* teaching are reduced.

Teachers, themselves, "are better informed on any subject in which instructional films are used." Teachers say that they appear before their classes armed with much more accurate information and much broader concepts than before, because they have had access to instructional films.

Learning Is Being Facilitated.

Instructional films are increasing the possibilities of presenting information on the basis of social maturity when lack of achievement in the tools of learning otherwise postpones it. Children of ungraded classes are much happier as a result of the availability of instructional films. Information pitched to what is ordinarily considered secondary level is made practicable with the aid of sound on films.

Instructional films are promoting learning readiness. In the primary period where many children are timid and where individual differences are very marked, instructional films are a real advantage as a leveling agent; they stimulate discussion, give the children common experiences, and promote freedom. In other grades, children are introduced to new areas of experience through seeing and hearing. The vocabulary is tuned to the content so that the children may see relationships that make them ready for learning in a new area of culture.

Instructional films are providing information which may not be secured otherwise. Demonstration of the way plants manufacture their own food and of the way the body stores and uses its food are two illustra-

tions. Pictures of people of other lands make the world more realistic to the children. Some members of the school board who saw a demonstration of the use of the film "OUR EARTH" summarized their opinions by saying, "I learned more geography in fifteen minutes than I learned from reading a whole book when I went to school."

Instructional films are stimulating creativeness on the part of the children. Plays have been written. Expressions through art media are frequent results. Children who saw "NAVAJO INDIANS", "PEOPLE OF CHINA", and "PEOPLE OF THE CONGO" were very much impressed with the artistic expression of these people. They created designs and made pottery because of their interest in these films. Even "FOODS AND NUTRITION" inspired a large poster—"The Sun's Rays Making Vitamin D." Posters giving information concerning diet have been made and placed in all school cafeterias.

Perhaps one of the most pleasing creative activities is that of oral expression. The voices of the commentators and their well-chosen vocabularies have made a real impression upon the children. There is interesting evidence of their effort to improve their voices and their diction. It might not be amiss to say here that the children and the teachers are interested in securing some means of recording and studying their voices with the idea of improving them. Several recording devices have been demonstrated in the Danville schools.

Instructional films are stimulating research. Teachers, children, and the supervisor have been stimulated and sometimes forced to learn many things. Biographies of scientists have been studied. "More about" birds of prey, plant life, foods, musicians, have been sought by interested groups.

Instructional films are increasing the opportunities to expand concepts. In studying plant life, some comments were made indicating that this is true:—"I knew that when we planted seeds, roots grew down and stems came up, but I didn't know that the seed had the plants' first food." "I am glad we saw the embryo in the egg because I didn't know until then that both plant and animal life come from the embryo."

Instructional films are stimulating active interest in related activities. In some instances, children who studied "FOODS AND NUTRITION" have given guidance to the cafeteria manager and to children of other grades in the choice of adequate diet. Pictures of birds, plants, and animals have led to hobbies. Experiments have been made to discover the effects of foods on plant and animal life. Foods are tested for starch, sugar, proteins, carbon, etc.

Instructional films are making learning more pleasant. This statement is based on expressions from the children and the teachers. School is made much more interesting. There is no doubt but that instructional films have improved attendance. The children look forward to *seeing information.* They go to the film room with their notebooks and pencils. They have become skilful in making brief notes and in making well-organized reports extemporaneously. It is not uncommon to hear children say "I like our classroom films much better than the shows downtown."

Instructional films are stimulating informal discussion. Teachers are especially pleased about this because it gives them better opportunity to understand pupil personalities.

Flexibility in the Use of Instructional Films

Instructional films are not confined to any particular grade. A single film may be shown to a grade with one or a number of purposes in view. The same film may be shown to one or several grades to expand one or many concepts, according to the needs of the children at a given time. When equipment must be left in the auditorium, it is entirely possible to let

A Plan for the Use of the Film "LEAVES"

Purpose 1: To provide for continued expansion of the concepts that
Man depends upon plant life for his existence
A balance tends to exist in nature
Plants store sun energy which is necessary for all life
The sun is the source of energy

Purpose 2: To further intelligent interest and enjoyment in plant life

Immediate purpose:
To see that leaves are the original source of food and that plants are the original storage places.

Presentation of Film

Child's interest, knowledge and concepts constitute starting point	*Are the children growing in their understanding that*
Recalling Information	
Name some plants Name some ways in which plants differ How are they alike? What do all plants need to make them grow? How do you get air? What do you inhale? Exhale? Animals would soon perish if they were confined in an airtight place. Can you explain why? You need food just as plants do. Can you name the kinds of foods and tell in a general way what contributions they make to the body? Name some meat-eating animals Name some plant-eating animals You named some foods and their contributions. Where do we get our foods? Where do the animals which we eat get their food? How can we tell from observation that animals store some foods in the form of fat? Protein? Do you like raw meat? Raw vegetables? Do people ever eat raw meat? How do we make meat and vegetables more palatable? How do we preserve foods? Can you name some food elements that are destroyed by heating?	Plant life consists of all growing plants from tiny grass blades to giant trees All living things must have food and air Green plants must have sunlight Animal life cannot purify the air which it exhales Plant life makes oxygen which is necessary for animal life Foods of different kinds are necessary for normal growth of animal life Some animals are meat eating Some animals are plant eating Animals depend upon plant life either directly or indirectly That both plants and animals store food. Foods are refined by cooking Heat changes the taste and value of foods Heat and cold help to conserve food

I want you to see a film with me. It tells and shows you many things. I want you to enjoy it. I also want you to remember some facts that are related to the things which you have been telling me. To help you remember them best, I have here some questions. Let's read them. I want you to think of the leaf as the original food factory and of the plant as the original storage place. All of you know what a factory is. Let's list here the things that make a factory that should help you to organize your facts more quickly.

Questions on Film

What are the parts of the plants which provide us with food? What is the function of each part? What are the parts of a leaf? What does the microscope show about the composition of a leaf? How can a leaf be compared to a factory? What happens to the sugar which is manufactured? What classes of foods are stored in plants? Then in what way would you say that we are dependent upon plant life?	Plants have different parts that have different kinds of work Leaves are really the source of food Leaves are constructed to do a job Sun is source of energy. Plants store sun energy. Plants breathe. Plants store foods Animals have only one source of food—plants

■ If you wanted to explain to the rest of the class or to your family that leaves are the original food factory and that plants are the original storage places, how would you do it?

Demonstration of a Plan Designed to Initiate a Study of Life in Argentina

Educational Aim.—To develop a tendency to seek causes and consequences of social conditions.

Broad Social Aim.—To promote a spirit of good will between nations that are alike or different in race, religion, nationality, beliefs, or ways of living.

Some Broad Social Concepts Pertinent to Problem at Hand.—Increasing knowledge and understanding of South America (Argentina)

Man's customs, occupations, habits of work, and modes of living have been affected by climate, natural resources, and topography. Man is increasing his control over nature.
The social heritage and behavior of one group may differ from that of another.
Man's survival and happiness depend upon his ability to make adaptations.
Peoples are dependent upon each other and have responsibilities to one another.
Group problems and responsibilities increase with increasing interdependence.
Man's control over social relationships has lagged behind his control over nature.
Man's personal liberties have decreased as social provision for cooperative living has increased.
Through conference, compromise, and persuasion man may learn to so regulate his social relations as to maintain a democratic way of life.

Procedure:

Teacher-pupil orientation
Mutual recognition of the problem and consequent responsibilities
Setting up a working guide by exploration and evaluation of present behavior (current practices) in solving conflicts occurring in the social life of the group
Development

Children's knowledge, interests, concepts, and behavior constitute starting point	*Evidence of awareness of immediate problems and of attitude toward them*

Questions

Questions	Evidence
Why do you choose certain people for your friends? What are some of the reasons that you have for not choosing others? How do your parents sometimes feel about your choice? How do you defend your choice? Would you choose a stranger for your friend? Why?	Do the children reveal a democratic disposition in the choice of friends? Are they aware that economic status plays an important part in their choice? Do they show an appreciation of personal worth? Are they developing a power of discrimination?
Do classes in your school have conflicts? Do you ever quarrel with school people in other sections of your city? Do you have conflicts to and from school? Have you ever sat in a group in or out of school when you tried to settle difficulties? What happened? Do you have clubs in and out of school? How do you organize? How do you decide upon policies and questions?	Do the children show a disposition to promote desirable social relationships in their classroom, school and neighborhood? Do they generally voluntarily undertake to settle persisting conflicts? Is there evidence of growth in the understanding that social problems can best be solved by the democratic method—conference, compromise and persuasion?
Do you ever dispute with others on the questions of religion and politics? Do you think that everybody should have the same opportunity to secure an education, to vote, to say what he thinks? Is it fair that some people should be very, very poor and some very rich? Do we want the Negroes to have as much education and property as we do? Would our country be better or worse if the Negroes had clean attractive homes, were healthy and clean themselves and were well educated?	Are the children growing in the awareness that race, social and economic inequalities are conditions which may effect unfriendly relations? Are the children aware that tolerance is greatest where customs, ideas, manners, and feelings are similar? Are they aware that friendly interest is conducive to friendly relationships? Are they aware that personal sacrifice is sometimes necessary in order to realize some desirable social goal? Are the children becoming more actively interested in broad social welfare? Are the children ready yet to accept the principle of equality of opportunity?

Possible Transition from Life Situations to Interpretation of Content

We have been exploring our feelings about what causes friendly or unfriendly relations to exist among ourselves and among people in general. We agreed that we would not choose a stranger for a friend because we wouldn't know anything about his character or his interests.

We agreed, too, that where we are involved in conflicts we should undertake to solve them in conference—with understanding, persuasion, and compromise.

Again: We are here to suggest some way to promote inter-American friendship. Have you heard of the Pan American Union? What is it?

Do you know of any reasons for conflict between the Americas? There are many. Some of them are the same that we have in every community, state, and region of the United States—labor, race, religion, economic conditions, resources, customs, and traditions.

Remember this: One interest which generally draws nations into friendly working relationships is trade—that is, exchange of what a nation has for what it does not have. With that in mind let's look at Argentina.

Approach: Review of knowledge formerly gained using map: Western Hemisphere	*Possible concepts and skills*
In what direction is South America from us? What are the ABC countries? Why called?	*Are the children growing:*
Who settled South America? What languages are spoken? What are the Latin countries of Europe? Who are the Latin Americans? Who settled Argentina? What language would they speak? In general, what customs would they have?	In the understanding that the social heritage of one group may differ from that of another?
In what zones is Argentina? What would you expect to find growing there? What season is she now having? We are in this longitude ——. Is it earlier or later in the day here than in Buenos Aires?	In their understanding that climate and topography condition the kinds of work in which man engages?
What is shown about the surface? Which way do the rivers drain? What ports do you see? What advantages are there in river seaports?	In the ability to interpret maps?

Presentation of Film "ARGENTINA" (Initial)

Let's see what this film has to contribute to our understanding of possible trade relations with Argentina. We shall see a part of it—life in Buenos Aires. As you see the film note the kinds of work that the people are doing; the kinds of products they have; any use of scientific knowledge; the imports and exports, and the kinds of power used to do the work.

Interpretation of Film

Knowledge gained from seeing the film	*Evidence of growth in concepts and skills*
The commentator introduces us to Buenos Aires as the "giant metropolis of predominantly agricultural Argentina." What two things does that sentence tell us?	*Are the children growing in their understanding that:*
He tells us in the next sentence: "Buenos Aires is a great center of commerce industry finance"	Interdependence increases as specialization in industry increases
What illustrations were there of commerce? of industry? of finance?	Machine production tends to increase interdependence
What are the stages shown in the meat-packing industry? What makes this plant "hum with activity?" What heavy machine manufacturing did you see?	Wise use of invention and discovery improve living conditions
Then what does Argentina lack in natural resources? What does the commentator mean to tell us in his statement, "For many products of heavy industry Argentina lacks materials and facilities required for domestic manufacturing?"	Natural resources condition the kinds of industries in which man engages
What scientific knowledge has helped Argentina become first in the meat export industry?	Machines make mass production possible
What does the work of the grain broker indicate about other agricultural products of Argentina?	Man's mode of living is affected by the natural conditions of the country.
Why do you think the broker gets a foreign car?	People in different environments tend to exchange goods
What are the imports? Exports?	People depend upon each other for variety of goods and services.

Generalization from Film

Recalling the information which you got from the film: Does Argentina have what we want? Do we have what she wants? Is there a problem? Do you feel that you *know* enough about this stranger to solve the problem?	Are the children growing in their ability: To generalize? To use appropriate vocabulary?

In the other part of this film some products which we do need are mentioned. In your geographies you will find still others. There are also graphs and tables showing Argentina's products in comparison with other countries. Find out if we have enough of everything which she has. You will have many more suggestions when you have studied all of the Latin American countries.

two or more grades see the same picture with different purposes in mind. The discussions preceding and following the showing are carried on in the classroom. Such a situation may be the exception rather than the rule, but it has been done.

Consider the purposes for which the film "LEAVES" may be shown:

To review or to learn the characteristics of leaves by which plants can be identified.
To see the function of the different parts of a plant.
To see a microscopic picture of the composition of a leaf and the function of each part.
To see that some leaves have become so modified through evolution that they are no longer true leaves.
To see that the structure of some leaves serves as a protection against animal life.
To see the processes whereby food and oxygen are manufactured within a leaf.
To see that sunlight is necessary for the life of plants.
To see and hear a science vocabulary in a functional situation: blade, midrib, vein, roots, stem, leaves, margin, function, microscopic, cell, chlorophyll, carbon dioxide, oxygen, pores, respiration, photosynthesis, transpiration.
To see the relationship of plant life to animal life.
To use with study of "FOODS AND NUTRITION" to better understand the dependence of animals upon plants for their food.
To use in the study of nutrition to see similarity of plant and body processes in the use and storage of foods.
To use with "FOOD AND NUTRITION" to see that plants contain the food elements necessary for the development and maintenance of health.
To use with "FLOWERS AT WORK" and "SEED DISPERSAL" to get a more thorough understanding of the life cycle of plants.
To expand the concept that the sun is the source of energy.
Note: Information in addition to that contained in the film is found in books and in nature, in and out of the classroom.

A small part of a film may be shown to clarify some problem, to answer a question or to meet the need of some individual. Parts of several films may be shown for comparison. An example of this, as mentioned, is the case of seeing how art is an expression of the temperament of the people and seeing that environment affects the artistic expression of people.

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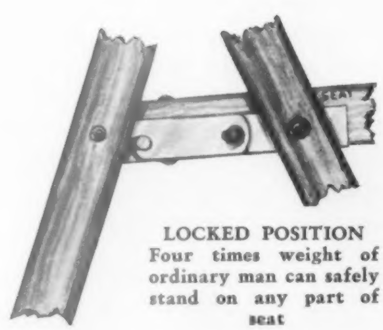

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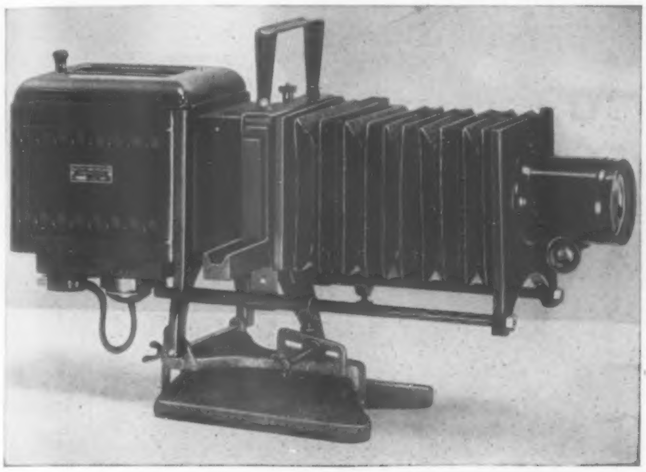

BDT BALOPTICON—For Slides Only

This extremely popular model is inexpensive, sturdy in construction, compact, easily portable and highly efficient. Its optical system is of exceptionally high quality and (depending on the lamp and lens used) can be used at distances from 4 to 80 feet from the screen. Image sizes range up to as large as 10 feet on the longer side. Maximum illumination. Extremely simple to operate. Still film, micro-projector and overhead projector attachments are available. The sturdy, tilting base is adjustable in two meridians and permits leveling the Balopticon even when placed on an uneven surface. This mounting allows for changing the projection angle for screen at various heights.

Model B is the same instrument as the BDT but without the tilting base. It is recommended for use where a permanent installation is being made, although it is readily portable.

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Catalog E-11, "Balopticons and Accessories," completely describes our line of Balopticons, many of which were omitted here due to lack of space. Micro-Projectors for school and college use are the subjects for Catalog E-20. For informative on Bausch & Lomb Microscopes and Spectographs see page 293 of this book.

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Manufactured to the high standards of performance that characterize all Bausch & Lomb projection equipment, the performance of the B&L 2" x 2" Slide Projector is characterized by brilliant, crisp, sharply defined screen images plus comfort, safety and convenience in operation. Shows black and white or color transparencies. An ideal instrument for showing slides made by the instructor or by the students themselves.

This projector is substantially made and is fitted with a high efficiency Bausch & Lomb optical system. This consists of a 150 watt, single contact base bulb with a silvered, concave reflector, a triple lens condenser, one lens of which is special heat absorbing, and a five-inch *f*: 3.8 B&L Cinephor Projection Lens of the same type as used in professional motion picture projectors. Slide carrier permits use of cardboard, metal or glass mounted slides.

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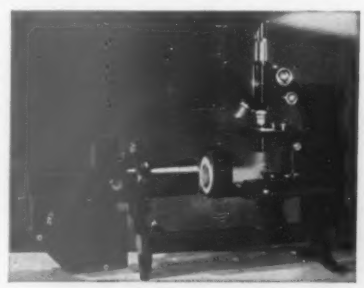
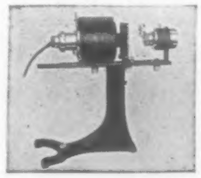


Simply place the microscope on the stage of the projector in an upright position, apply the prism reflector cap to the microscope and focus the illuminator. Complete directions accompany each projector.

Investigate this new instrument before completing your plans for science laboratory development.



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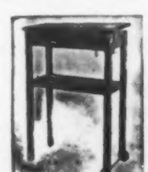
Especially designed and priced for high schools, this extremely efficient unit serves three definite purposes—(1) projection of permanently mounted specimens on a screen from 4 to 15 feet away. (2) making drawings of microscopic fields. (3) projection of living specimens in liquids. Exceptionally sturdy in construction. Has both coarse and fine focusing adjustment. A two-power projection lens is included.

BALOPTICON TABLE



The B&L Balopticon Table provides a means of placing a Balopticon where it can be used to best advantage. It is portable (rollers on two front legs), and has a shelf underneath for slide boxes.

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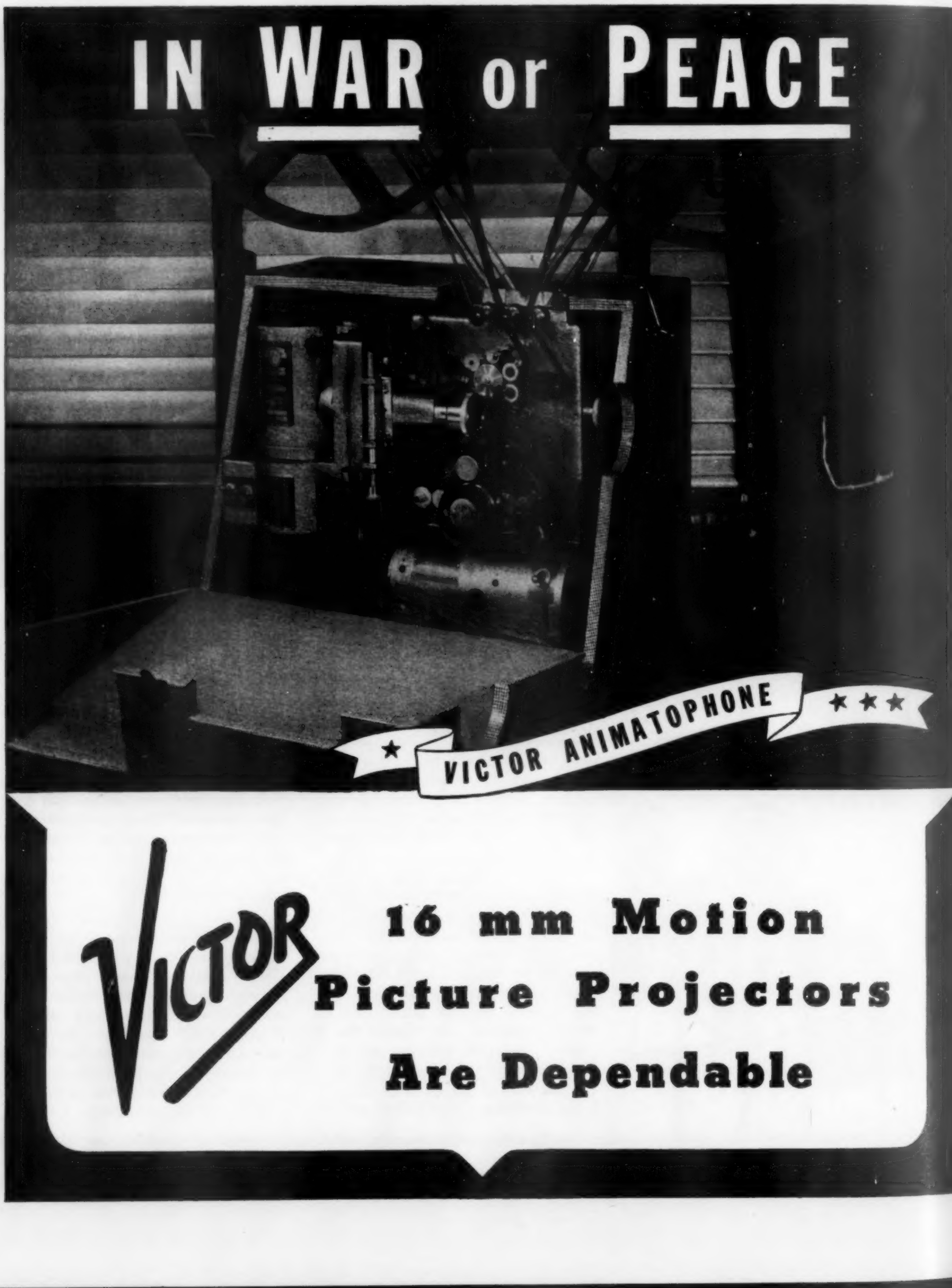

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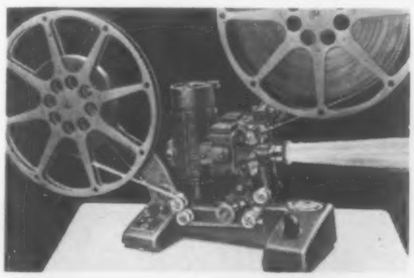

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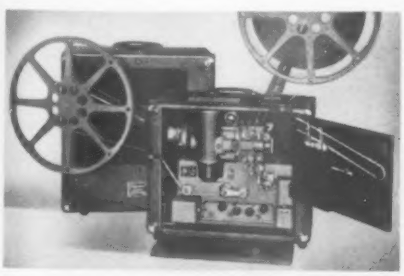

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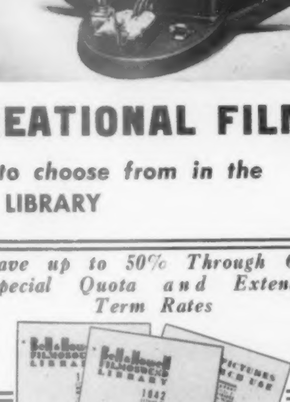

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EDUCATIONAL DEPARTMENT, RCA VICTOR DIVISION

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RCA AUDIO-VISUAL AIDS HELP TRAIN OUR SOLDIERS

In training camps, men of the armed forces attend movies that help make them better fighters and finer soldiers. These movies, prepared by the Government, train troops in the handling of various weapons, in defensive tactics, maneuvers, coordination of attack, etc. RCA audio-visual equipment, used in these camps, is an essential part of America's military training program.

HERE'S SOMETHING YOU CAN DO . . . *NOW!*

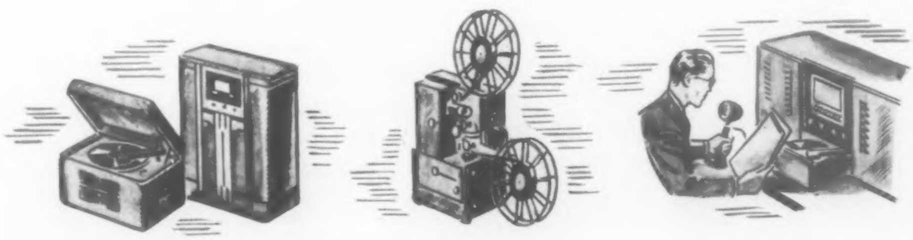
War demands need not mean your school must be entirely deprived of the benefits of RCA audio-visual aids. If you now have phonographs or a school radio-sound system, Victor Records can still serve you. There are Victor Records to aid in teaching many subjects, particularly music and literature. If you have a motion picture projector, there are free RCA films on Television, Radio Broadcasting, Radio Tubes and their uses, and the RCA Electron Microscope. These are especially fine for use in radio and science classes.

RCA PRODUCTS FIGHT ON ALL FRONTS

Other RCA products normally available to you, are also serving on the home front. In war plants, RCA radio-sound systems speed production, maintain morale, combat fatigue. In laboratories where war research goes on, the RCA electron microscope is busy. RCA tubes, transmitters, receivers and other radio electronic products are also playing vital roles wherever our men are fighting.

PUBLICATIONS YOU CAN PUT TO USE

There are RCA technical publications for use in radio and science courses—RCA Receiving Tube Manual; RCA Air-Cooled Transmitting Tubes; Radiotron Designer's Handbook; and free booklets on the RCA Electron Microscope, RCA Television, Radio and the War. The quarterly magazine, "Radio Age," is available to instructors and administrators without charge. In addition, there are special text and reference books for music education and music appreciation—The Victor Book of the Opera; What We Hear in Music; Music and Romance; and Music Appreciation for Children. These are supplemented by smaller free booklets on American Music, Latin-American Music, Folk Dances, Choral Music, etc.



THE TIME TO PREPARE FOR TOMORROW IS NOW!

When peace returns, you will depend on audio-visual aids more than ever before to meet new problems and develop new techniques of education. The best way to prepare for that time is to do your planning now. Our educational experts and engineers will gladly consult with you and plan arrangements suited to your school's specific needs. After the war, RCA audio-visual aids—from records to film projectors, from sound systems to laboratory test equipment—will be even more perfectly developed to serve every educational need. Plan **now** to equip your school with these important aids. Write to Educational Department, RCA Victor Division, Radio Corporation of America, Camden, New Jersey.

ERPI CLASSROOM FILMS INC.

1841 Broadway
New York, N. Y.

BRING THE WORLD TO THE CLASSROOM

Erpi Classroom Films Inc. is an organization devoted exclusively to the service of education.

It was organized in 1929 and produces sound films specifically for instructional purposes.

Erpi instructional sound films are designed to present elements of subject matter which cannot be presented as effectively by the use of any other medium of communication. They augment the established teaching procedure. They speed up and enrich the entire educational process.

Educational institutions all over the world are finding that through the use of this new teaching tool they are able to present many fundamental aspects of subject matter which heretofore have had to be neglected because of the limitations of traditional methods.

The films in the Erpi library have been produced by experienced educators in collaboration with over one hundred of the country's leading subject matter specialists. Because they are intended for purely instructional purposes authenticity of content is a fundamental policy of the Erpi organization. While this frequently requires many months of exacting and rigorous research, Erpi believes that it is absolutely necessary in order to guarantee competent presentation and instruction.

Erpi's catalog contains descriptive and illustrative information on more than 200 films in the fields of

AMERICAN HISTORY	GEOLOGY
ANIMAL LIFE	HUMAN BIOLOGY
ART	MUSIC
ASTRONOMY	PHYSICS
ATHLETICS	PLANT LIFE
CHEMISTRY	SOCIAL STUDIES
CHILD GROWTH	TEACHER TRAINING
GEOGRAPHY	

PRIMARY—NATURAL AND SOCIAL SCIENCES

Erpi instructional sound films are used extensively in all the states of the Union and in 29 foreign countries.

Erpi extends a cordial invitation to educators to visit the Erpi headquarters and view the films suitable for individual needs and requirements. Correspondence and inquiries about Erpi films are also invited. The Erpi catalog will be sent to you upon request—*write for your copy today!*

Erpi Classroom Films Inc.

WEBSTER ELECTRIC COMPANY

"Where Quality is a Responsibility and Fair Dealing an Obligation"

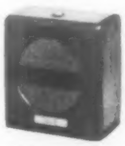
Racine, Wisconsin, U. S. A. Established 1909. Export Department:
100 Varick St., New York City. Cable Address: "ARLAB", New York City

WEBSTER ELECTRIC Teletalk REG. U.S. PAT. OFFICE

SYSTEMS of Amplified Intercommunication

Teletalk provides instant 2-way natural voice communication between rooms, departments and buildings. Models such as the Master Unit illustrated at left are available to accommodate up to 24 stations in a system. Stations may be called individually, or any selected group of stations (or all stations) may be called simultaneously.

12-Station Master Teletalk Unit Model 212AM. Annunciators indicate when another station is calling.



Speaker-Microphone station 5A-45B with push button annunciator signal.

Teletalk operates directly from the light circuit. Installation merely requires that interconnecting wires be provided between stations. Where all communications are from or to master stations, the use of speaker-microphones for outlying locations gives efficient service at very moderate cost.

Teletalk units are available with earphones or handsets for confidential conversation, with annunciators and other facilities to meet individual or special requirements. Catalog on request.

Larger Intercommunication Systems

Teletalk Amplified Intercommunication is also available for large schools, institutions, colleges and universities requiring systems of 24 stations up to 200 or more. A central or master station, usually located in the business or principal's office, can call any room or department and hold two-way conversation; or signals that come through the built-in annunciator system notify when any outlying station wishes to talk.

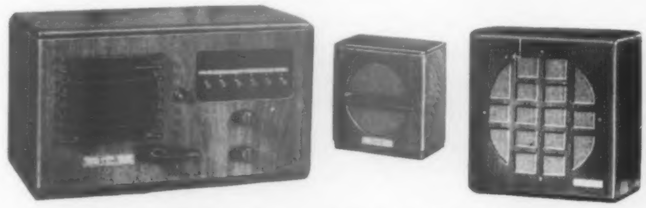
Illustration shows Teletalk Master Station with facilities for communicating with 96 rooms. Earphone is used for confidential reception.

This equipment can be varied to meet any special communication requirements. Provisions for confidential conversation, paging, sound distribution and public address may be included.

Webster Electric Paging Systems

It is an established fact that an individual responds much quicker to a voice calling his name than to a signal assigned to him.

Webster Electric Paging Systems are available from 6 stations on up. With Webster Electric Teletalk Paging Systems it is possible to page a person at one station, or all stations simultaneously. Combination speaker-microphones can be had, making it possible for the person being paged to carry on a two-way conversation with the operator at the master station. All systems carry volume control, all-call and selective-call features. These, like all Teletalk Systems, are designed to meet specific needs.



This is a twelve station master unit, and two of the many types of speakers available.

Webster Electric Sound Distribution Systems

Webster Electric Sound Equipment is available to meet every school requirement from small class room to large auditorium or stadium. Systems are available in 12 watts or more, with microphones, amplifiers, speakers and full equipment.

Webster Electric Sound Distribution Systems are now used by schools and universities from coast to coast. Cabinet type amplifier, shown at right, provides sound distribution for 60 rooms in several buildings of a great educational institution. Built into panel are a phonograph pick-up and turntable, a 3-band radio, monitor speaker, and 60 three position switches for intercommunication and sound distribution.

Consult your classified telephone directory for the name of your nearest dealer or distributor, or write direct detailing your specific needs. Webster Electric Teletalk Systems can be supplied to schools, colleges and universities which can supply sufficiently high priority ratings.

ART CRAFT THEATRE EQUIPMENT CO.

108 West 46th Street
New York City

OUR COMPLETE LINE OF PRODUCTS

Cycloramas—
Stage Curtains
Window Draperies
Asbestos Curtains
Ground Cloths
Painted Exteriors
Lighting Equipment
Stage Hardware
Wood Tracks
Steel Tracks
Motor Controls
Picture Screens
Rigging, Installed
Velour Rope Railing

RENTALS

We maintain a complete rental department.

It is frequently expedient to rent a curtain or back drop for a special scene.

If your school production requires additional drops or cycloramas—velour, satin or painted drops—advise us your requirements.

Write for Circular "A"

REQUIREMENTS FOR QUOTATIONS

1. Width and height of proscenium.
2. Height from stage floor to ceiling.
3. Depth of stage.
4. Width on stage.

★

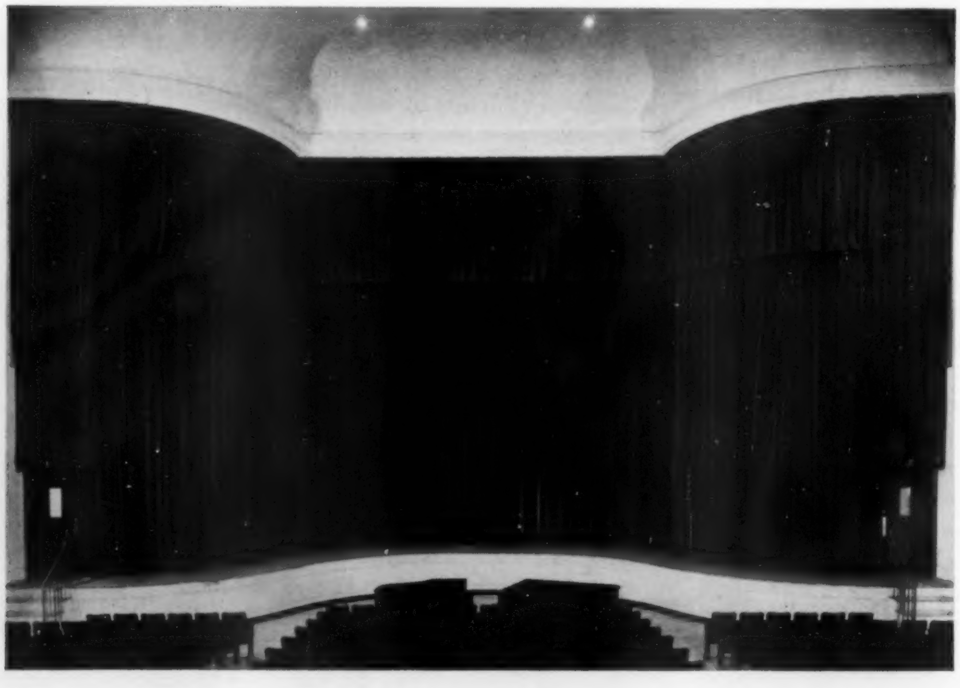
Upon receipt of measurements, samples and price will be mailed at your request.

SERVICE

All inquiries are given prompt attention. ART CRAFT can help solve your technical problems. No obligation.

Take advantage of our many years of experience in manufacturing stage equipment.

Our work is thorough, prompt. Our interest in your success is constant. Therefore you will find our services useful and beneficial.



An ART CRAFT Installation
Collins Hall
FORDHAM UNIVERSITY

Center stage proscenium, 21′ high by 32′ wide by 30′ deep. Completely equipped with rope and counter balance rigging.

Two-side stages, size, each, 12′ x 12′ x 21′ high.

Side curtains operate on circular tracks. When drawn open, they form an unusual setting.

Architects:
O'CONNOR & DELANY
New York City

AUTOMATIC DEVICES COMPANY

1037 Linden Street, Allentown, Pa.

EXPORT DEPARTMENT—220 W. 42nd Street, NEW YORK, N. Y., U. S. A.

DIRECT FACTORY REPRESENTATIVES

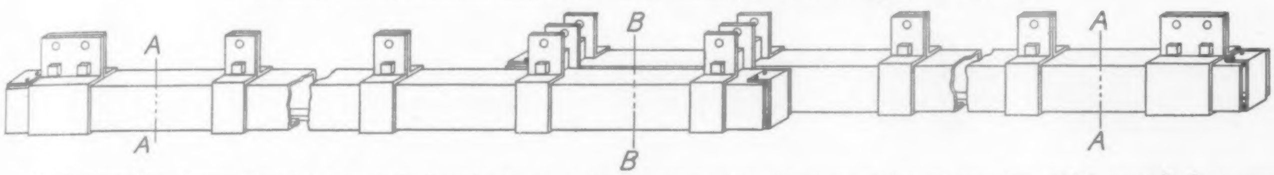
CHICAGO, ILL., N. C. Nussbaumer, 1050 N. Humphrey Avenue, Oak Park, Ill. ST. LOUIS, MO., A. M. Pollack, 1310 Midland Drive

PRODUCTS

"Silent-Steel" Heavy Duty Curtain Track.
"Besteel" Medium Duty Curtain Track.
"Steelite" Light Duty Curtain Track.
"Aerial" Type Unit-Combination Track and Machine: 1/3 hp.
"Silver Service" High Speed Curtain Machine: 1/2 hp.
"Autodrape" Standard Curtain Machine: 1/3 hp.
"Autodrape" Special Curtain Machine: 1/4 hp.
"Stabilarc" Motor-Generator for Projection Arc Supply.

CURTAIN TRACKS

Turnbuckles, Pipe-Batten Hangers, Wall or Ceiling Brackets Supplied as Desired

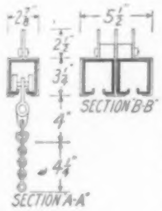


To Determine Gross Length of Track Required—As a basis, start with the clear width of opening which curtain is to uncover; i.e., distance between inside edges of curtain halves when in open position. Add 10% for lap at center for curtain when closed. Add 10% for extension on each end to accommodate each half of curtain when in open position. Total addition is 30%.

Example: Open curtain is to expose 30 ft. clear width. Add total of 30% or 9 ft. for center lap and both end extensions. Specify 39 ft. gross length, in two sections each 19 ft. 6 in.

"SILENT-STEEL" HEAVY DUTY CURTAIN TRACKS

For Any Length—with Curtain of Any Weight



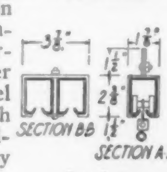
Section Dimensions

Suggested Specifications—Curtain tracks shall be of full-steel construction, 14-gauge, entirely enclosed, except for slot in bottom, each half to be one continuous piece and free of any riveted, welded or other mechanical joints regardless of length, except at center lap. Each curtain carrier shall be supported on ball bearings by two special composition rubber wheels rolling on two separate parallel treads, and all pulley blocks equipped with steel ball bearing wheels adequately guarded; Model No. 280 as manufactured by **Automatic Devices Company** of Allentown, Pa.

"BESTEEL" MEDIUM DUTY CURTAIN TRACKS

For Lengths up to 36 Ft.—with Light or Medium Weight Curtains

Suggested Specifications—Curtain tracks shall be of full-steel construction, 14-gauge, entirely enclosed, except for slot in bottom, each half to be one continuous piece and free of any riveted, welded or other mechanical joints regardless of length, except at center lap. Each curtain carrier shall be of cadmium-plated steel construction supported on self-lubricating bearings by two special composition rubber wheels rolling on two separate parallel treads, and all pulley blocks equipped with steel, ball-bearing wheels adequately guarded; Model No. 170 as manufactured by **Automatic Devices Company** of Allentown, Pa.



Section Dimensions

AUTOMATIC CURTAIN MACHINES

"Autodrape" Curtain Machines

All "Autodrape" machines are equipped with exactly the same gear reduction unit, base and automatic reversing switch mechanism, including the following features:

(1) **Limit Switch Arrangement** — Adjustment for "open" and "close" positions reduced to simplest form.

(2) **Elevator Type Traction Drive**—Maximum delivered power without slippage.

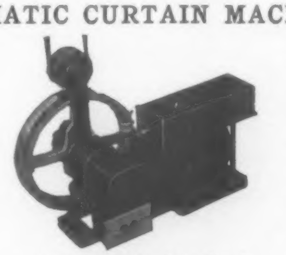
(3) **Mounting**—Endless cable design allows installation of machine at any position in vertical plane of track.

(4) **Disconnecting Clutch**—For conversion to hand operation.

(5) **Automatic Overload Protective Breaker**—Protects machine against excessive loads.

(6) **Motor**—1/4 or 1/3 hp., single phase.

(7) **Speed**—92 or 115 ft. per minute, equivalent to curtain separation of 2¾ or 3½ ft. per second, respectively (based on 60-cycle current).



"Autodrape" Standard Model

Over-all dimensions: 19⅛ in. long, 10 in. wide, 15⅛ in. high

"Autodrape" Special Models—These models have features listed at left and are the lowest priced fully automatic machines on the market; 1/4 hp.

Recommended for use with "Silent-Steel" or "Besteel" Tracks up to about 36 ft. gross length.

"Autodrape" Standard Models—In addition to the features listed at left these models include idler system and finger-tip control switch attached to machine; 1/3 hp.

Recommended for use with "Silent-Steel" Curtain Tracks up to about 50 ft. gross length.

"Silver Service" Curtain Machine

This model has all the features of the "Autodrape" Standard Machine. It is equipped with 1/2-hp. motor delivering a cable speed of 125 or 155 ft. per minute equivalent to curtain separation of 4 or 5 ft. per second.

Recommended for use with "Silent-Steel" tracks up to about 80 ft. gross length.

REPRESENTATIVE INSTALLATIONS

Public Schools
New York, N. Y.
Philadelphia, Pa.
Baltimore, Md.
Cleveland, Ohio
Washington, D. C.
Newark, N. J.
Buffalo, N. Y.
Seattle, Wash.
Providence, R. I.
Pittsburgh, Pa.
Sacramento, Cal.

Theatre Circuits
Paramount-Publix
Warner Bros.
Balaban & Katz
R-K-O
Loews
Fox
Wilmer & Vincent
Comerford

Hotels
Waldorf-Astoria and Park Plaza, New York
Miami-Biltmore, Miami
Palmer House and Stevens Hotels, Chicago
Mayflower, Washington

Industrial Exhibits
General Motors Co.
Sears, Roebuck and Co.
Ford Motor Co.
General Electric Co.

U. S. Government
Army Posts
Naval Stations
Veterans' Hospitals
Department Bldgs., Washington, D. C.
Public Health Hospitals
Resettlement Projects
Housing Administration

Colleges
University of Chicago
U. S. Military Academy
Swarthmore
University of Maine
New York University
City of New York
Connecticut College
Georgetown University
Drexel Institute

Miscellaneous
Radio Stations
Municipal Auditoriums
Masonic Lodges
Y. M. C. A.
Churches
Clubs
Art Museums

For Complete Information and Samples of Track write to Automatic Devices Company, Allentown, Pa.

J. R. CLANCY, INC.

Syracuse, New York

Designers and Builders of Stage Mechanical Equipment

Amherst College Playhouse—Completely equipped with Clancy Rigging. —McKim-Mead & White, *Architects*

Purdue University Music Hall. . . . Clancy equipment here consists of Steel Asbestos Curtain, Orchestra Lift, Stage Rigging, and, of course, all the controlling mechanism.—Walter P. Scholer, *Architect*

DON'T WORRY...

Your Stage Is Set FOR THE DURATION with

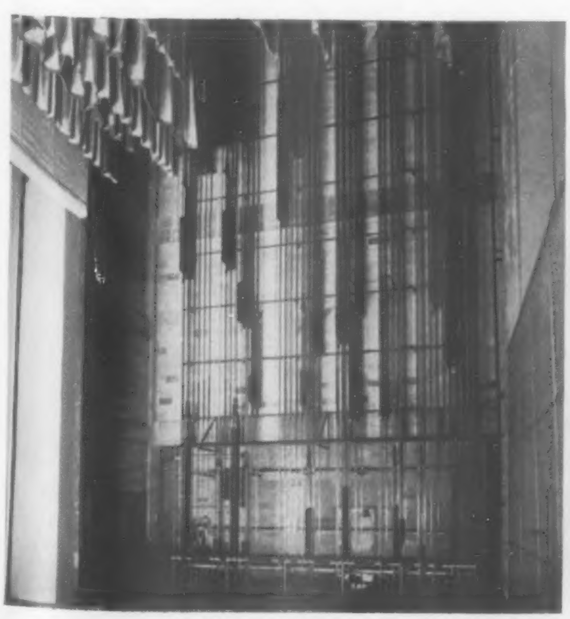
CLANCY EQUIPMENT!

Safety and dependability for long time service have always been our watchwords in the production of fine equipment for the American Theatre. Proof of this is the number of theatres still using Clancy equipment installed more than 50 years ago. If you are fortunate enough to be using our modern equipment you know that it will outlast this war. And to be doubly sure . . . if your equipment doesn't have our self-lubricating bearings, keep it well-oiled and its service will be improved.

Here are several of the outstanding installations J. R. Clancy has made—all of them stages of professional character which can be arranged to accommodate the drama, sound pictures, lectures, or concerts. Should you have any problem or need involving stage equipment, write us—we shall be delighted to advise you to the best of our ability and to place at your disposal our complete engineering service.

WE'RE WORKING OVERTIME TOO!

The skill of Clancy craftsmen is now being used in making precision tools for winning the war. When Victory has been won, we shall again be back to serve you more fully than ever as the world's largest manufacturers of Stage Equipment and Theatrical Hardware



←Typical Clancy designed and equipped stage. Note the offstage floor is clear of equipment. Only 21" of space is required along the wall for complete operation

Whittier Union High School, Whittier, California — one of the outstanding school stages of the country. Clancy designed and equipped.—*W. H. Harrison, Arch.*

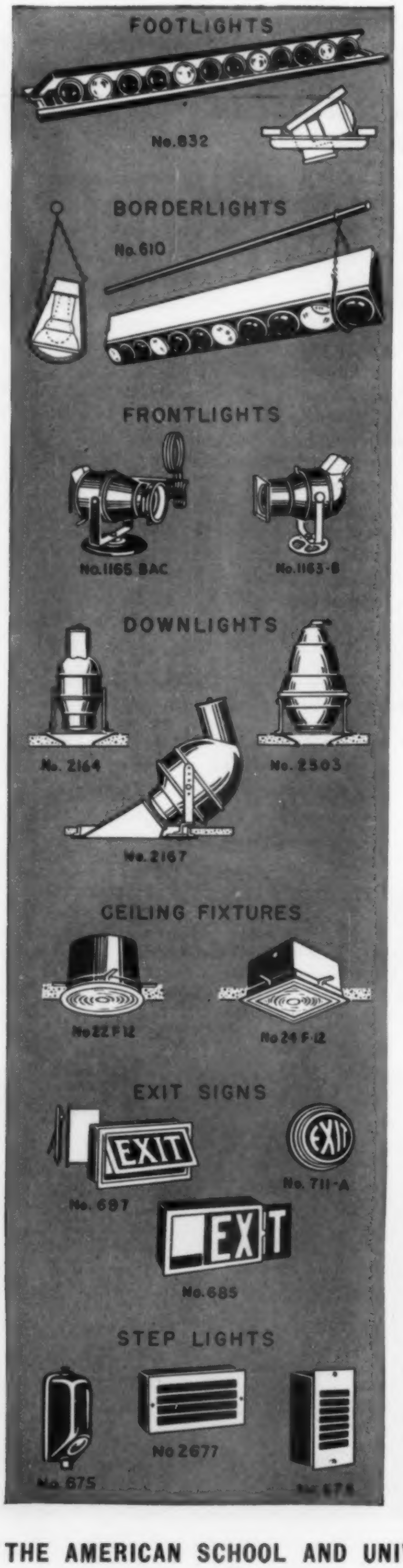
Originators and Manufacturers of "KLIEGLIGHTS"

KLIEGL BROS.

UNIVERSAL ELECTRIC STAGE LIGHTING CO., INC.
EST. 1896

STAGE and AUDITORIUM LIGHTING

321 West 50th Street,
New York, N. Y.
Tel. COlumbus 5-0130



AT PRESENT our production facilities and personnel are wholly engaged in the war effort—to the end that victory may soon be won.

Many of our products used in normal activities are now serving the armed forces in diverse ways, and special devices have been developed for the needs of war.

Priorities and war-time restrictions limit the articles we can supply for civilian requirements — however, we are doing all that we can to lessen the difficulties and to supply the essential needs of our customers during the emergency.

When the restrictions are lifted we will be ready and eager to serve your peace time requirements—with new ideas and latest developments in theatrical and architectural lighting.

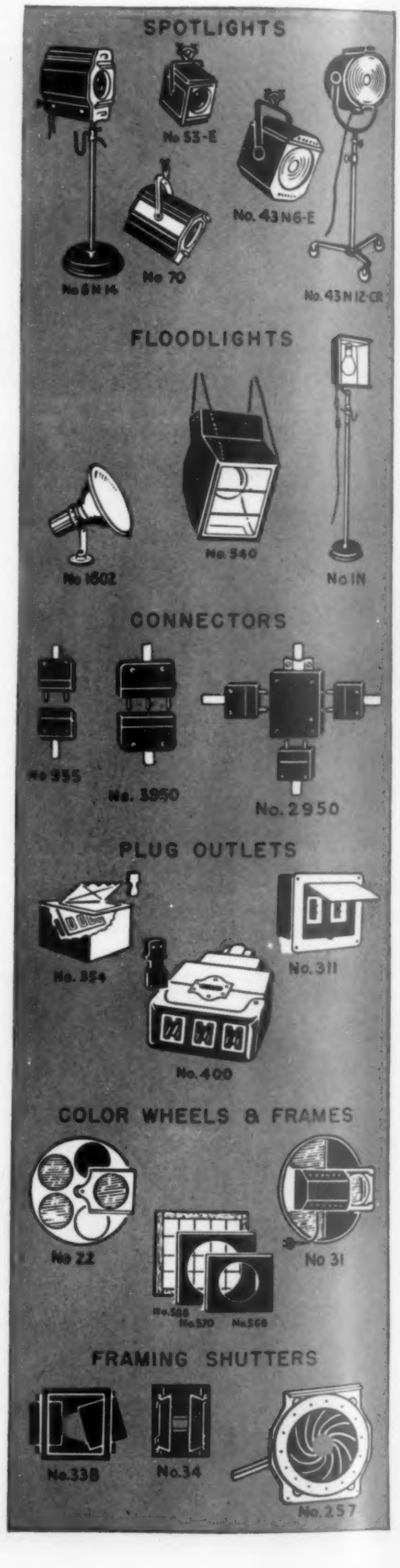
INQUIRIES

Information regarding our products or production facilities furnished on request. Our engineers are available for helpful services in the solution of current problems or post-war planning. Your inquiries are invited.

KLIEGLIGHTS

High intensity beam projectors with ellipsoidal reflectors, lens system, and coordinated shutter arrangement which permits regulation of size and shape of light beam.

Portable units have an in-built four-way shutter system, with external controls to facilitate quick and easy adjustments. Permanently installed units have a drop-in shutter arrangement. Full particulars on request.



HOTCHKISS

Dept. U, Norwalk, Conn.

"Pioneers in All That's Best in Stapling"

Hotchkiss Staplers Prove Their Value in Classroom and School Office

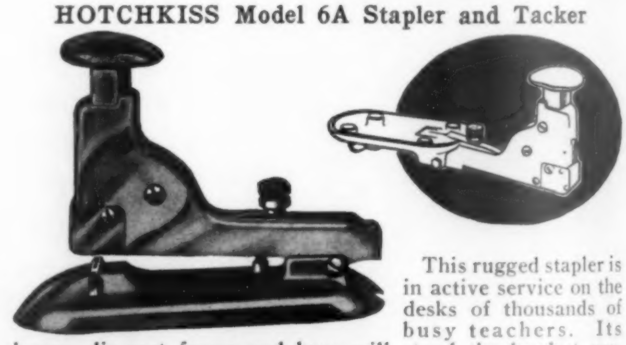
Classroom papers and business forms can be classified and organized better with them. Stapled papers occupy less space in file drawers. Staples require less wire and are economical to use. Hotchkiss staplers are made to stand hard usage and have given years of service in many schools.

HOTCHKISS Model 122P Stapler and Tacker

Here is a handy, double duty stapler and tacker that is small enough to fit in purse or pocket or it can be kept in a corner of the desk drawer. To staple papers, just squeeze it like a plier. It holds 105 economical standard size staples, the same size as are used by most of the larger desk models.

By swinging the base down and around it becomes a useful light duty tacker. Teachers like them for tacking up papers, for pinning drawings on drawing boards and hundreds of other uses.

HOTCHKISS Model 6A Stapler and Tacker



This rugged stapler is in active service on the desks of thousands of busy teachers. Its heavy, die-cast frame and base will stand the hardest use. The capacity of Model 6A is 105 Standard Size Staples and it is fitted with a duplex anvil which permits fastening papers with a permanent clinch or with the Hotchkiss exclusive temporary clinch. The latter type permits the staple to be removed like a pin with the fingers—a very handy feature.

The base may be swung down and locked back so as to use the machine for tacking papers and drawings to walls and drawing boards. Rubber feet in the base prevent scratching desks. Finished in handsome black crackle lacquer.

CHISEL-POINTED TRADE-MARK

HOTCHKISS Chisel-Pointed Staples

For Easy Stapling

These staples have keen chisel points and penetrate material easier than ordinary blunt pointed ones. They are made of correct gauge wire to micrometer exactness and fit the machines perfectly.

Have your local Hotchkiss Stationer or Wholesaler show them to you or write Hotchkiss direct. The Hotchkiss Guarantee is your protection.

MILLER-BRYANT-PIERCE

Aurora, Illinois

Established 1896 | Division of L C Smith & Corona Typewriters Inc | Direct Branch Service

MANUFACTURERS

of

Typewriter and Other Inked Ribbons . . . Carbon Papers . . . Stencil Inks

Give the "WHACKS" What They Deserve!

Whether on the fighting front or the home front, the "soldiers" who operate the writing machines of the Nation deserve the best materials and equipment it is possible to produce.

War Conscious Writing Machine Ammunition!

The fighting fiber of Miller Line typewriter and other inked ribbons, carbon papers and stencil inks, is established by nearly a half century of experience in the development of ribbons, carbon papers and inks . . . by its organization of trained experts some of whom have been making Miller Line ribbons and carbons for more than four decades . . . and by its modern plant completely equipped for the production of these products.

INKED RIBBONS

—made regularly in all standard colors and standard color combinations, record or copying, and in seven different degrees of inking, for any machine requiring an inked ribbon:

Typewriting Machine Ribbons
Hectograph Ribbons
Billing Machine Ribbons
Bookkeeping Machine Ribbons
Adding Machine Ribbons
Pollard Alling Ribbons
Tabulating Machine Ribbons
Photolithographic Ribbons
Speedaumat Ribbons
Addressograph Ribbons
Dating Machine Ribbons
Time Stamp Ribbons
Time Clock Ribbons
Inked Ribbons for Multigraphing

CARBON PAPERS

—made in a complete variety of grades, weights and finishes, in all standard colors and sizes, for any purpose where a carbon paper may be utilized:

Typewriting Machine Carbon Paper
Billing Machine Carbon Paper
Bookkeeping Machine Carbon Paper
Copying Carbon Paper
Hectograph Copying Carbon Paper
Pencil Carbon Paper   Pen Carbon Paper
Tracing Carbon Paper
Tabulating Machine Carbon Paper
Carbon Rolls
Adding Machine Rolls, plain or carbonized
Binder Carbons (sewed)
Elliott Addressing Machine Stencil Carbon Rolls
Elliott-Fisher Rolls
Tally Rolls (Underwood and other machines)

STENCIL INKS FOR MIMEOGRAPHS

—open drum, closed drum, fountain feed, portable.

Prompt and Careful Attention given to special or unusual requirements by our Research and Development Departments.

The Miller Line MILLER LINE is Superfine

POSTINDEX COMPANY

VISIBLE INDEX FILE DIVISION

(ART METAL CONSTRUCTION CO.)

Jamestown, New York

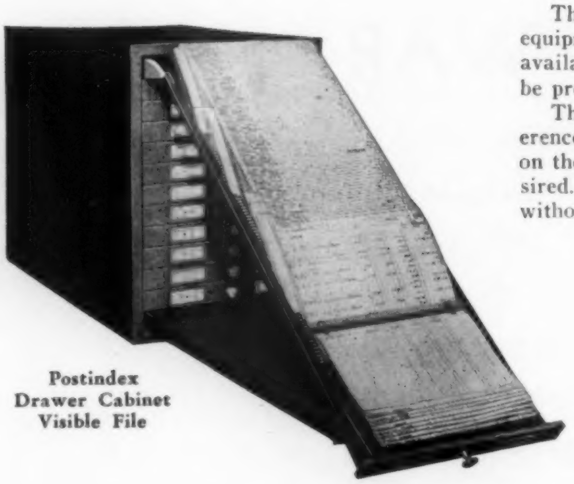
BRANCH OFFICES

Baltimore, Md.	Chicago, Ill.	Hartford, Conn.	Philadelphia, Pa.
Boston, Mass.	Detroit, Mich.	New York City, N. Y	Washington, D. C.

600 SALES AGENTS IN ALL PRINCIPAL CITIES

THE TURNING POINT IN BUSINESS CONTROL
POSTINDEX
VISIBLE FILES

POSTINDEX MODEL 8 DRAWER CABINETS



Postindex Drawer Cabinet Visible File

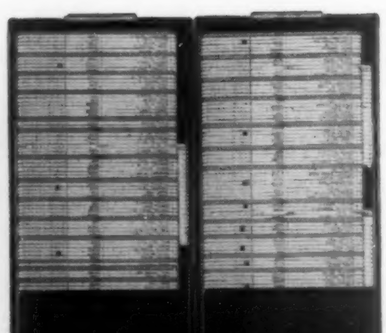
The Postindex Drawer Cabinets are generally accepted as standard equipment for many school record requirements. Standard cabinets are available in a large variety of card sizes. Any size and any capacity may be provided for in the Postindex line of Drawer Cabinets.

This line of Postindex equipment is especially convenient for quick reference purposes since the proper drawer may be quickly located by the index on the front, and as quickly extended for finding of the card or record desired. Postindex is also fastest for posting purposes as posting is done without taking the form out of the file.

This type of equipment gives an unusually fine appearance in offices where attention to such refinement is desired. A single cabinet or a battery of these cabinets may be put on a roller caster stand so the installation may be rolled to different locations in the office, or up alongside a certain desk, when particularly desired for prolonged reference or posting.

The trays are quickly removed in case it is desirable to temporarily separate one or several trays from the installation for reference and posting at some other location. The standard trays have on an average of 90 records per tray. This varies slightly one way or the other depending upon the size of the card.

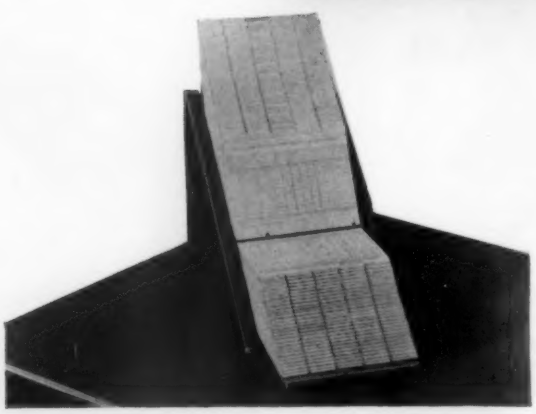
Write for Circular



MODEL 5 FLAT BOOKS AND CABINETS

Model 5 Flat Books are most widely used among school administrators because they are readily adapted to either large or small installations and because of compactness and the convenience in handling. Flat Books are easy to post because they lie flat on the desk. A large number of records are seen at one time as an average Flat Book will hold 140 records. The books furnish a fully protected unit to carry about to any part of the building. They lend themselves ideally to housing in safes when not actually in use. Books may be purchased one at a time to add to present installation. Flat books are made of aluminum and very light to handle.

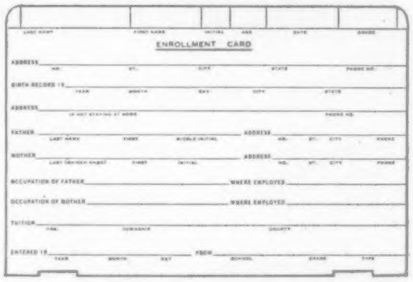
Write for Circular



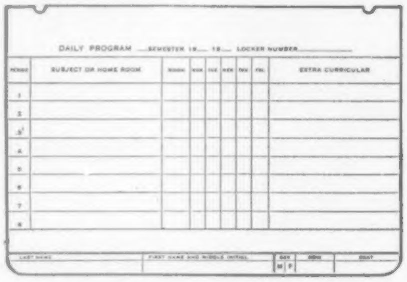
VERTICAL STUDENT ROSTER

This unit is designed to permit immediate transfer of student records from present blind files to visible file with up to 375 names in sight at one time. The record forms are simply placed in the slotted index cards and name labels inserted under celluloid tabs. The unit illustrated is WV-Z8575-C for 8 x 5 forms and is completely assembled ready to use with a supply of index labels.

Individual School Census Card
Postindex form 81-C-6385-8. This shows one side of a two-page card which incorporates complete census information and attendance information. The back side of this card shows history of employment



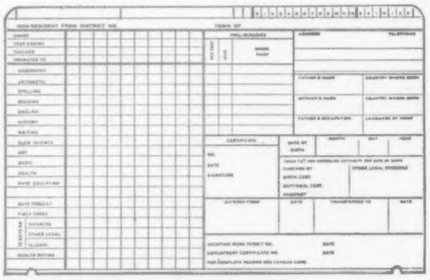
School Enrollment Card
Postindex form 81-B-2916-8P. This is a two-page form with illustration showing the enrollment record. The back side of this same card covers daily program record



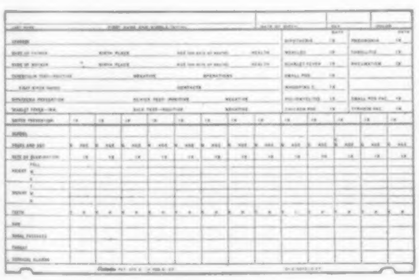
Individual Child's Daily Program
Postindex form 81-B-2913-8. This is a four-page form with illustration showing the daily program for a student. The other pages are devoted to registration information and attendance

Individual Pupil Cumulative Record
Postindex form 81-C-06072-8CT. This illustration shows one page of a four-page form covering educational history, ability and achievement test record. The other three pages provide for scholarship record and health information

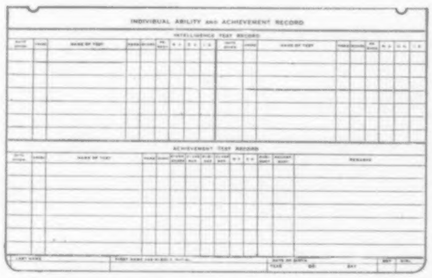
Secondary School Cumulative Record
Postindex form 81-C-05971-8CT. This illustration shows one page of a four-page form with academic record and attendance information. The other three pages provide for general information, extra curricular activities, achievements, with space for intelligence and achievement tests



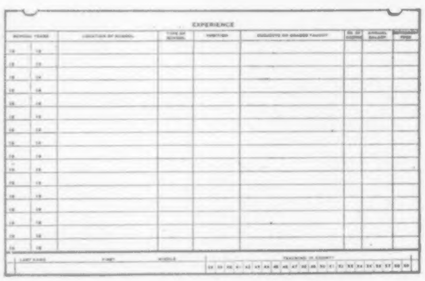
School Cumulative Record
Postindex form C-4077-P. This is a four-page form with illustration showing the elementary scholastic record. One of the other pages covers scholastic record for Junior and Senior High School while the other two pages provide space for recording pupil activities, guidance facts, intelligence and achievement tests



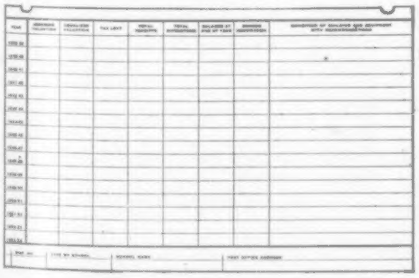
Individual Health Record
Postindex form 81-C-06121-8CT. This is a four-page record with illustration showing a portion of health history. The other three pages are devoted to a continuation of the same record



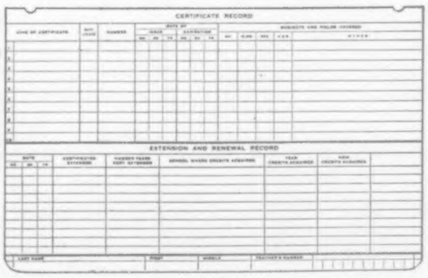
Individual Achievement Record
Postindex form 81-C-6387-8. The illustration shows front side covering intelligence tests and achievement tests. The back side is a continuation of achievement tests



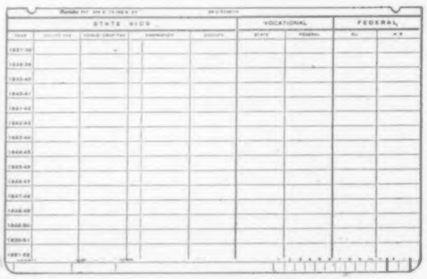
Teacher's Card
Postindex form 81-C-06112-8CT. This is a four-page record with illustration showing teacher's experience. The other three pages are devoted to personal information, educational background, special training and certification, health and general remarks



County Financial Accounting Record
Postindex form 81-C-06111-14CT. This is a four-page form with illustration showing financial record. Other pages are devoted to census, enrollment, attendance and information about board members, also State and County financial support



Florida Form
Postindex form 81-C-6370-8. This is a four-page form with illustration showing the teacher's certification, extension and renewal record. The other three pages are devoted to experience, training and general information



Wisconsin Form
Postindex form 96-C-5740-14. This is a four-page form with illustration showing State Aid data. The other three pages provide record in regard to statistical information, census, enrollment and teachers

THE GLOBE-WERNICKE CO.

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For over 60 years this company has been a leader in developing useful office accessories, school and library equipment. Globe-Wernicke products are dependable and enable people to do more and better work. Sold by dealers in almost every city.

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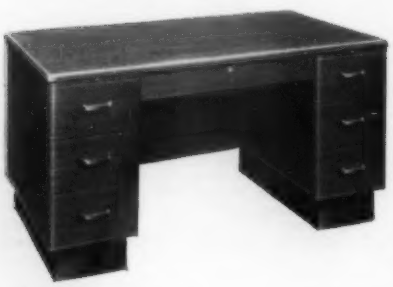
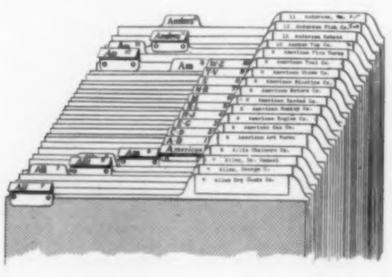


These streamlined wood desks are excellent examples of fine wood craftsmanship with revolutionary airplane type construction. The many desirable built-in features in these wood desks provide greater comfort . . . convenience and efficiency . . . truly appreciated by the user. Available in beautiful imitation walnut or medium dark green finishes.

SAFEGUARD FILING PLAN



Users appreciate the many advantages of the "Safeguard" filing plan. It helps prevent errors . . . protects valuable papers from becoming lost . . . saves time and money. This system was developed by Globe-Wernicke after many years' experience. It is the safest, simplest and best method of filing . . . easy to understand and operate . . . economical and practical.

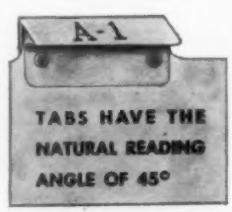
Free . . . write for 8-page illustrated filing chart, "For Faster Filing and Finding."

"DEFENDER" WOOD FILES

"Defender" all-wood filing cabinets are attractive and will give very good service. They meet the requirement for dependable and economical filing equipment. The wood is air-seasoned . . . properly kiln-dried . . . carefully selected for uniform good quality as well as for appearance.

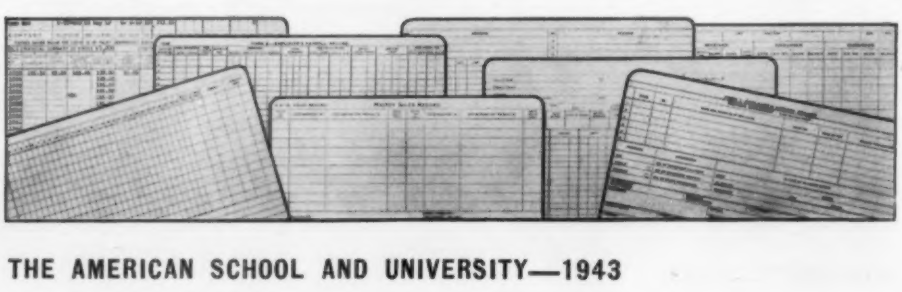
Files are equipped with progressive type wood suspension with rollers that permit drawers to glide easily and quietly. Available in 2, 3 and 4-drawer letter and legal sizes. Furnished in beautiful imitation walnut . . . or medium dark green finishes.

ANGULAR CELLULOID TAB GUIDES



For speed and accuracy in filing or finding use Globe-Wernicke angular celluloid tab guides. Easy to read . . . easy to find . . . no stooping or pushing contents of drawer about to read labels. Tabs have the natural reading angle of 45° . . . "look you straight in the eye." Inserts are removable, making possible unlimited expansion. Indexing is always visible . . . every tab stands out clearly and distinctly. Made in letter, legal and card index sizes.

VISIBLE RECORD FORMS OF MANY KINDS ARE AVAILABLE TO FIT ANY BUSINESS NEEDS



Globe-Wernicke stock or special visible record forms are available for every record-keeping requirement. Let us study your present methods and recommend card forms that will help you know the facts about your business instantly. See the new Globe-Wernicke wood visible record equipment.

EVERYDAY FILE

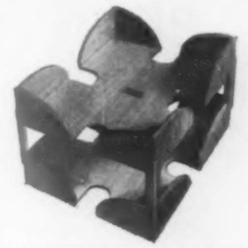
Handy . . . speeds up filing . . . sorting . . . a work organizer. Furnished in letter and legal sizes. Various styles . . . tabbed alphabetically . . . days of month . . . also with tabs having removable inserts.

BOX FILES

Needed in many offices and often used for personal filing. Practical and inexpensive. Available in letter and cap sizes. Choice of several styles of indexing. Convenient to handle.

AGATE CARD INDEX TRAYS

A useful and economical card index tray made of heavy binders' board . . . equipped with wood bottom and wood follower. For 3 x 5", 4 x 6", 5 x 8" and 6 x 9" cards . . . and check file sizes.

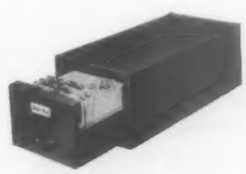


ACCESSO WOOD DESK TRAYS

Wide hand openings on all four sides and bottom make it easy to handle papers. Made in letter and legal sizes . . . available in several finishes.

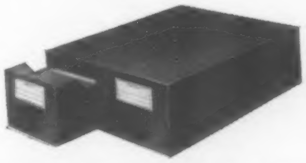
RECRUIT WOOD TRANSFER CASES

A dependable transfer case for economical storage filing. May be loaded to capacity . . . furnished without compressor, which assures maximum space for storage filing. Letter and cap sizes . . . furnished only in green finish.



RECRUIT WOOD CARD INDEX CABINETS

Available in one and two-drawer styles for 3 x 5", 4 x 6" and 5 x 8" cards. These dependable card index cabinets will give satisfactory service. Outside depth dimension 15". They are furnished in an attractive medium dark green finish.



PILOT . . . FIBREBOARD CARD INDEX CASES

Pilot fibreboard card index cases are unusually strong. They are covered with green cloth . . . made in one and two-drawer styles for 3 x 5", 4 x 6", 5 x 8" and 6 x 9", cards. Drawers are double thick at front and back . . . fitted with black finished wood knob and wood follower operating on counter-sunk wood rod.

TUFTEAR MANILA FILING FOLDERS

Tough and strong . . . they stand up under hard constant use . . . rounded corners help prevent torn, "dog-eared" edges, increasing the life of the folders. Furnished in medium (8 pt.), heavy (11 pt.) and extra heavy (14 pt.) weight stock. Made in all standard styles of tabbing.

GLOBE-WERNICKE SECTIONAL WOOD BOOKCASES

. . . for Home and Office

Globe-Wernicke sectional bookcases protect books from dust and damage . . . add to the appearance of the home or office and permit expansion to meet individual needs . . . "grow as your library grows." Globe-Wernicke sectional bookcases are available in a variety of styles and finishes . . . harmonize with other furniture.

★

Illustration shows ECONOMY STYLE sectional bookcase . . . unexcelled for schools . . . public and private libraries . . . offices and homes . . . available in plain or quartered oak . . . imitation walnut and mahogany finishes

PRODUCTION of library equipment has been temporarily suspended. After the war, Globe-Wernicke engineers and the unexcelled facilities of our factory will again be available to solve library equipment problems.

★

PENN METAL CORPORATION OF PENNA.

46 Oregon Avenue, Philadelphia, Pa.

SALES OFFICES IN PRINCIPAL CITIES

1869 Penco

IN BUSINESS CONTINUOUSLY SINCE 1869

PRODUCTS FOR PEACE

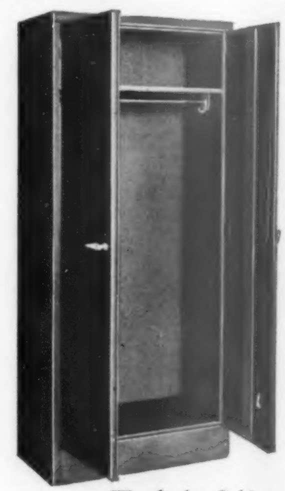
STEEL LOCKERS -- STORAGE and WARDROBE CABINETS
STEEL SHELVING -- TOOL UNITS -- METAL SPECIALTIES

Single Tier Locker Type 50-U-2

Box Lockers Type 40

PRODUCTS FOR WAR

Many standard Penco products have now been adapted for the sole use of Government services, as well as various items of special equipment. While manufacture of Penco *steel* products *is* restricted, most of the items are available in wood for essential civilian needs. The same sound, engineered construction applies to these conservation substitutes as to our normal products developed over a period of seventy-three years. Complete information and specifications on Penco steel or wood equipment will be given on request, for either current or future use.



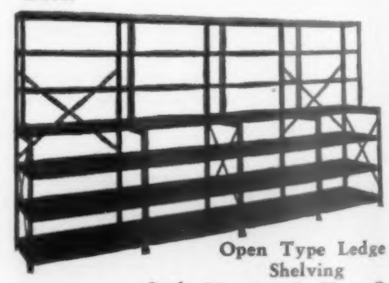
Wardrobe Cabinet Type 3618-W

STEEL CABINETS

for wardrobe, storage or combination use are made in many styles and sizes.

8-Compartment Locker Type 82

2-Person Lockers Type 734



Open Type Ledge Shelving Style No. 117-L, Type B

STEEL LOCKERS

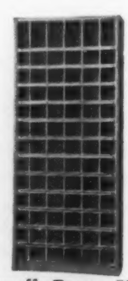
Penco single tier, double tier, box and multiple lockers of various types provide the complete storage facilities needed by all schools.

STEEL SHELVING

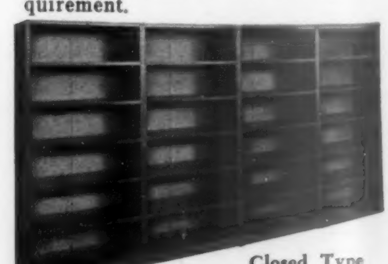
Six basic types of Penco Steel Shelving are available, which with readily added accessories provide facilities to meet every storage requirement.

Steel Table No. 651

Steel Counter No. 652



Small Parts Unit No. 154



Closed Type Plain Shelving Style No. 118, Type A

Special metal storage equipment made to suit individual requirements

NATIONAL LOCK CO.

Rockford, Illinois

BRANCH OFFICES

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Rochester
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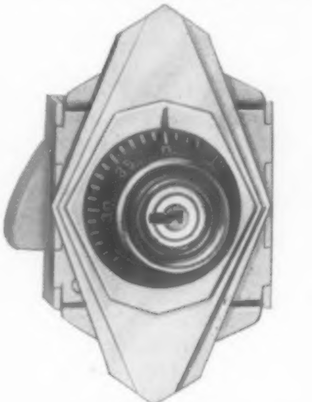
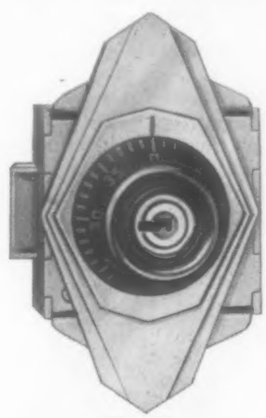
St. Paul
San Francisco
York, Pa.
Toronto, Ont.

ROCKFORD COMBINATION LOCKER LOCKS are made for standard Steel, Wood or Masonite Lockers of any style or make. It is the complete line assuring the utmost in security, convenience, simplicity and durability. Rockford Locks have proven their worth in hundreds of Educational Institutions. For simplified and complete supervision and control select the Rockford Line.



NO. 267

Master Keyed Combination Self Locking, for use on Lockers having spring latch bar. Over 64,000 different combinations available. No bolt or rivet heads visible from outside. Can also be furnished without Master Key feature.



NO. 269

For use on Box type Lockers having no latch bar. Lock has beveled spring bolt. Closing door locks lock and spins dial concealing last figure of combination. Furnished with or without Master Key feature.

NO. 271

Master Keyed Combination Dead Bolt Lock having square end dead bolt. Lock does not have self-locking feature. Combinations of this lock and Nos. 267 and 269 can easily be changed by removing escutcheon plate and turning dial.

COMBINATION SHACKLE LOCKS

NO. 265

Keyless Combination Self-locking Shackle Lock that is fool proof, secure and durable. Inserting shackle upsets combination by turning dial. Must be completely re-dialed to open. Over 64,000 different combinations available. This is a very popular lock in the Rockford Line. Lock case is Chromium Plated and dial is black with white figures.

NO. 264

Master Keyed for ease and convenience of supervision. Can be Master Keyed with all built-in Locks shown above, or Laboratory Lock shown below. Students operate lock by combinations, while officials gain access by use of Master Key. Dial is locked against rotation when shackle is open.

NO. 275

COMBINATION SHACKLE LOCK

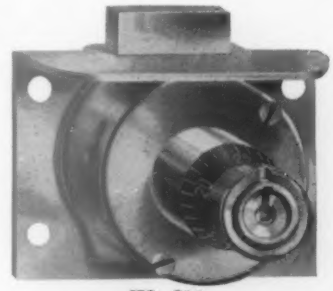
Where Locks are purchased by School authorities to be sold on a no-refund basis, this Lock is suggested. The finish is Baked Aluminum and Varnish, a very attractive item, and all mechanical parts of any importance are made of Brass. Parts requiring extra strength are made of Steel, Cadmium Plated and are completely rust-proof. The shackle is self-locking and there are over 64,000 combinations available. Dialing is ratchet or click type permitting rapid operation and the large numerals are easily read, even in dark corridors or locker rooms. This is a full-size Lock of special value and should be re-sold to the students at 10¢ to 25¢ more than the actual School cost.

NO. 275

NO. 259

COMBINATION DRAWER LOCK

Combination Master Keyed Laboratory Drawer or Door Lock. Combination can quickly be changed without removing lock from mortise. Lock is of Solid Brass construction and is not affected by ordinary Laboratory fumes and acids. Lock is reversible for use on right or left hand doors.



NO. 259

Illustrated here are only a few of the many School Locks available in the Rockford Line. Ask for illustrated folder showing complete line.

THE YALE & TOWNE MFG. CO.

TRADE **YALE** MARK Stamford, Conn. TRADE **YALE** MARK

INTRODUCE **true economies, maximum security and increased efficiency in locker rooms with these Yale Combination Locker Locks. They supply a degree of protection heretofore unavailable in locks of this type for locker use; security which discourages temptation, aiding in character development. Large easily read dials simplify operation, and minimize congestion and delay in locker rooms.**

FOR ALL MAKES AND ALL TYPES OF STEEL LOCKERS

FOR NEW LOCKERS AND FOR REPLACEMENT OF WORN OUT LOCKS ON OLD EQUIPMENT

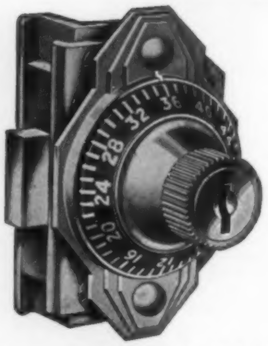
Exclusive Yale Features:

Maximum Security: Combinations dialed on three positive numbers. Combination must be known and cannot be located by manipulating dial.

Combination Disperser automatically upsets combination as lock is locked. A double safeguard. Acts as a defense against tampering.

Combination Changeable with every change of locker occupant—without removing lock from door. Feature secluded in back of lock in same secure manner as in Yale Bank Locks.

Supervisory Control of a group of lockers or the collective groups of a city school system obtained by the **Yale Emergency Key Control.** The key used is assigned exclusively to these locks.



For Lockers with Automatic Bolt Release Mechanism. Automatic Self-Locking Vertical Sliding Bolt. A New Locking Principle.

Emergency Key Controlled

No. L3374-CM, *Cadmium finish*
No. L3374-DZ, *Chromium finish*

Dial Operated Only

No. L3364-CM, *Cadmium finish*
No. L3364-DZ, *Chromium finish*

For Steel Compartment and Box Type Lockers. Beveled Spring-bolt, Automatic Self-Locking.

Dial Operated Only

No. L3369-CM, *Cadmium finish*
No. L3369-DZ, *Chromium finish*

Emergency Key Controlled

No. L3379-CM, *Cadmium finish*
No. L3379-DZ, *Chromium finish*

For Lockers with Gravity Type Locking Device. Dead Bolt Manually Operated.

Dial Operated Only

No. L3368-CM, *Cadmium finish*
No. L3368-DZ, *Chromium finish*

Emergency Key Controlled

No. L3378-CM, *Cadmium finish*
No. L3378-DZ, *Chromium finish*

NEW YALE COMBINATION PADLOCKS

FOR BASKET LOCKERS AND ALL OTHER TYPES AND MAKES OF STEEL LOCKERS

The finest and most secure combination padlocks yet produced

No. 589
Master-Key Controlled Dial

Same features of maximum security and automatic combination disperser as the above built-in type.

No. 579 Lock, Dial operation only.

No. 589 Lock, Dial operation with emergency key, provides supervisory control of lockers. May also be used with any of above built-in types under same control key.

These padlocks have ¼" diameter steel shackles and the graduations and numerals on the black enameled dial are easily read.

No. 515 Lock, Dial operation only. A good secure medium priced padlock. The steel shackle is 9/32" in diameter and the case of solid rustless metal is attractively finished in bright baked aluminum.

The Yale Rotating Dial provides fast accurate dialing.

The Combinations are unlimited on all above padlocks.

No. 515
Dial Operated Only

SECTION VII

HOME ECONOMICS—CAFETERIA—DINING HALL

SETTING UP EQUIPMENT AND PROCEDURES FOR COMMUNITY GROUP FEEDING

By **KATHARINE W. HARRIS**
Professor of Home Economics and Head, Department of Institution Management

and

DOROTHY PROUD
Extension Specialist in Mass Feeding

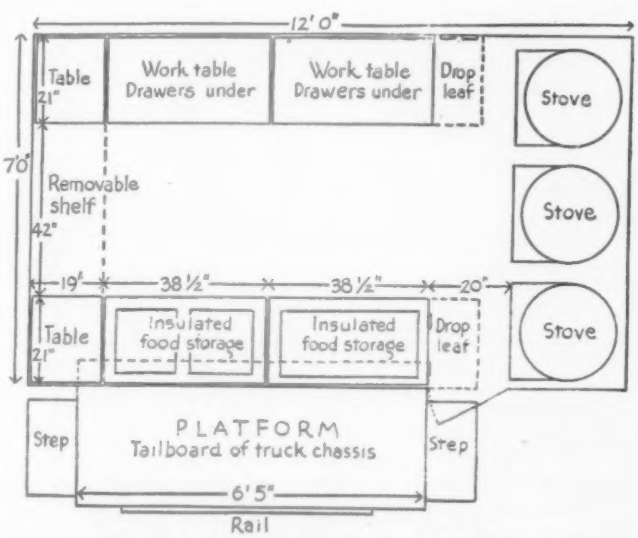
New York State College of Home Economics, Ithaca

WHEN we speak of community feeding in wartime, we are thinking of group feeding organized and carried through by efforts of volunteer workers. To many of us this means getting ready for possible disaster due to falling bombs or sabotage, or perhaps, at the present time, serving doughnuts and coffee to the troops passing through town. Britain's experiences, however, have taught us that the major task of community organization is providing nutritious, inexpensive food for the vast army of industrial workers and the children whose mothers are employed. Britain has enlisted the services of volunteers to help her feed these groups and now has some 1500 restaurants providing over 300,000 meals daily for workers and their families. School children receive a hearty noon lunch at school. In addition, mobile canteens serve warm cereal and a beverage to workers going to their jobs early in the morning before the restaurants open, or provide for tea in the afternoon.

Everyday Group Needs To Be Met

In our own country, there are similar everyday needs that, if met, will make for improved nutrition and better health for a large part of the population. Day nurseries are already being established and nourishing meals will be a part of their program. The school lunch should become increasingly important as more mothers are employed. Day camps and summer playgrounds can help to provide for the children during vacation periods and here too at least the noon meal should be served. Industrial workers need to be considered where rapid expansion of war production plants has overtaxed the communities' restaurant facilities. Hospitals and similar service institutions are finding it increasingly difficult to secure employees for the dietary department. In all of these situations volunteer workers could give valuable assistance and make it possible for these projects to go forward.

The question of what individuals and communities can do to get ready to care for group feeding needs has been given considerable thought. Thousands of women have taken nutrition and canteen courses, but have stopped there because the community had no definite plan for using their services. Others, more



Floor plan of the New York State College of Home Economics mobile kitchen. A portable utility sink can replace a stove

Simplicity, flexibility, efficiency, and economy are the virtues of this mobile kitchen, converted from a second-hand truck

APPROXIMATE COST OF CONSTRUCTION MATERIALS FOR MOBILE KITCHEN

(As of February, 1942)

Top of truck		$ 82.00
Pipe	$18.00	
Canvas	43.00	
Straps, buttons, etc	11.00	
Oak strips	10.00	
Walls of truck		42.00
Sides	13.00	
Tailgate	8.00	
Insulation behind cab	21.00	
Floor (insulation and covering)		23.00
Storage box for gas tanks		12.00
Storage box for horses		5.00
Equipment		88.00
Drop leaf	4.00	
Storage cabinets		
Metal lined	26.00	
Masonite lined	27.00	
Work tables, 8 drawers	7.00	
Work tables, 5 drawers	6.00	
Horses, tall	4.00	
Horses, short	2.00	
Ladder	5.00	
Steps	2.00	
Skeleton tables and removable shelf	5.00	
Portable sink	10.00	
Total		$262.00

venturesome, have taken leadership in attempting to take care of group feeding needs which they knew existed. Many times it is the homemaking teacher who must furnish leadership and it is she who must discover what the needs are and relate them to the facilities at hand.

The Homemaking Teacher Takes the Lead

Initial Steps.—One of her first jobs would be to contact the local office of civilian mobilization, the local Red Cross chairman, and the county nutrition chairman. In this way she could inform herself of any activities or programs under way in order to avoid misunderstanding and duplication of effort. If no survey has been made of local facilities for group feeding, then this might be a first step. A second step would be to interest church or other community groups in taking responsibility for seeing that the church or grange kitchen is clean, that equipment is in good repair and ready to use, and that these groups have worked out a plan for preparing and serving simple meals which they have tried out and perfected.

Rules for Meal Planning to Be Laid Down.—In working with church organizations or other volunteer groups whose facilities for serving large groups are reasonably adequate, the homemaking teacher should stress the following principles:

1. Serve simple, palatable, and nutritious meals rather than snacks.

2. Keep in mind the food habits of the people whom you are going to serve so that the meal will be enjoyed and eaten.

3. Plan to use the non-rationed foods available in your local community.

4. Think through the jobs to be done and plan ahead so that the meal may be prepared and served quickly and efficiently.

5. Consider the limitations of equipment and workers.

6. Maintain high standards of sanitation.

Demonstration, Then Practice

If the homemaking teacher is responsible for training volunteer workers to produce and serve food in quantities, then she must find experiences that will give these workers practice in the routine tasks involved in group feeding. Perhaps the school cafeteria or church kitchen could be used as a laboratory with people in the community invited to participate as paying guests, or perhaps there is real need for a school lunch in which volunteers could carry major responsibility for preparing and serving food. Emphasis should be given to the quantity procedures followed in preparing dishes such as soups, simple main dishes, sandwiches, and beverages. Demonstration of these procedures, followed by practice, is the best method of

MAKING SANDWICHES

General procedure

1. Allow plenty of work space (a wood-top table or large cutting board is most efficient). Have all materials prepared in advance; have knives, spoons, scoops, wax paper, damp towels, and storage pans assembled. If many sandwiches are to be made at one time, three or more persons can work together, each taking over one operation.
2. Have the fillings ready; if lettuce is to be used, it should be washed, well-drained, and crisped beforehand.
3. Soften the butter by leaving it for some time in a warm room and cream it with a wooden spoon or in an electric mixer using the flat paddle. An excellent procedure is to add ½ cup of milk to one pound of butter to make the butter creamy.
4. Cut the bread, or if already sliced, unwrap the loaves and stack ready for use. Cover with a slightly dampened cloth.
5. Arrange the slices of bread in rows on the work surface.
6. Spread the butter to all edges on one or both slices of bread, spreading several slices at one time as the bread lies flat on the working surface. When fillings such as cream cheese, peanut butter, or those containing mayonnaise are used, the butter may be omitted on one slice. Butter both sides when using jelly, or mixtures that contain moisture, or lettuce and tomatoes.
7. Arrange or spread the filling and dressing or relish on alternate slices of bread. If a mixed filling is used, distribute it with a measuring spoon or ice cream scoop to insure a uniform amount in each sandwich. Spread the filling neatly to all edges.
8. Put the sandwiches together and cut them in halves or triangles.

Holding sandwiches until needed

1. Place a damp towel on the bottom of a flat pan or tray; place wax paper over the damp towel.
2. Stack the sandwiches on this tray and cover them with wax paper.
3. Place a damp towel over the wax paper, being sure that the sandwiches are completely covered.
4. Store the sandwiches in a cool place.

teaching. The procedures for making sandwiches in quantity are suggestive of the type of subject-matter information the teacher should develop for each demonstration.

Volunteer participants learn to organize and carry through routine tasks efficiently by actually serving meals to the public. Dishwashing and kitchen housekeeping are an important part of this routine and should be included in the teaching program.

Where permanent facilities are inadequate a simple, inexpensive mobile kitchen may be needed. Such a kitchen, using a second-hand truck, has been developed at the New York State College of Home Economics.*

An example of the type of meal the homemaking teacher might choose, together with the organization market order, and other details, follows.

* See War Emergency Bulletin 36, 1942, New York State College of Home Economics, Ithaca, New York.

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Note: Quantity recipes and related information may be obtained from many of the commercial food companies.

A PLAN FOR A SIMPLE EMERGENCY MEAL[1]

MENU

Corn chowder *or* other hearty cream soup
Raw carrots and celery
Chopped egg sandwiches on whole wheat
Apple crisp or fruit
Coffee, tea, or fruit juice

I. *Number of workers and their duties*

The number of workers needed depends on the number of people to be served, the experience and efficiency of the workers, the equipment available, the efficiency of the unit, and the facilities available.

Six workers should be capable of preparing and serving the menu to 50 or 75 persons. The unit group would comprise: a chairman, a sub-chairman, 4 workers and 2 alternates to cover absences. If larger numbers are to be served, more workers would be needed and the chairman and sub-chairman would give more time to directing the group activities.

The chairman and sub-chairman should have an emergency file of several simple menus and the following information with each menu:

- Tested recipes
- Amounts of food to buy with information as to where the food may be secured
- Costs of the meals
- Special equipment needed
- Written instructions as to the specific jobs so that workers' duties may be assigned quickly.

When an emergency arises, the chairman and sub-chairman select the menu or menus with the related

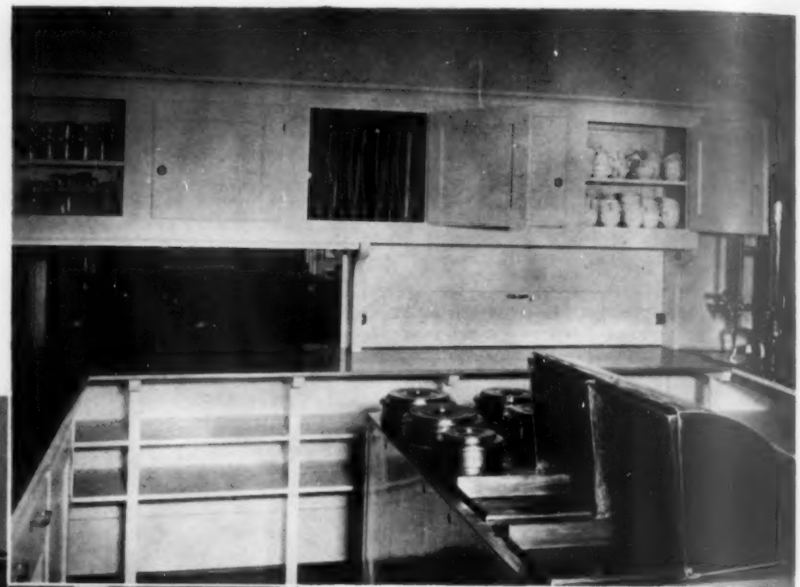
[1] Prepared by Marion Wood and Dorothy Proud of the Department of Institution Management, New York State College of Home Economics. Menus, organization of work, and records for community meals may be found in "Meals for Many." New York State College of Home Economics, Ithaca, N. Y.

MARKET ORDER FOR MENU

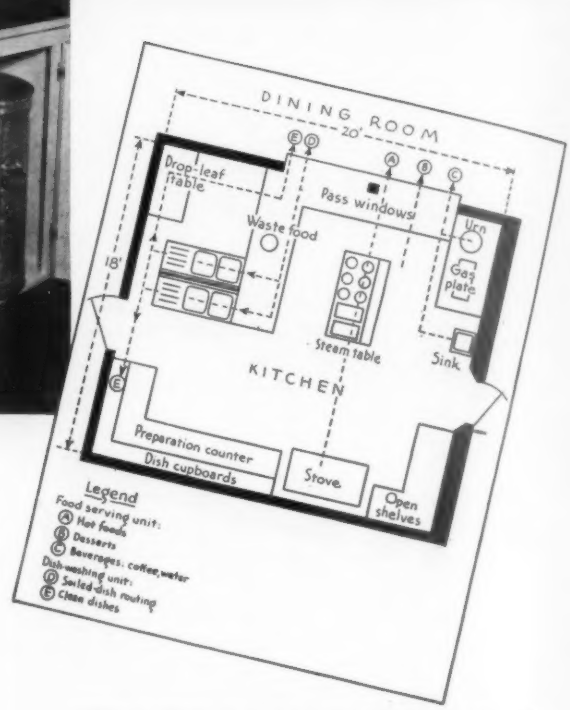
AMOUNT	FOOD ITEM	OTHER SUGGESTIONS
2 gals.	Milk	1 gal. evaporated milk (approximately 10 13-oz. cans) *or* 2 lbs. dry skim milk
1¼ qts.	20% Cream	2 13-oz. cans evaporated milk and 1 pt. milk
¾ lb.	Butter	Reinforced oleomargarine
3½ doz.	Eggs	Grade A or B, med. sized
¾ lbs.	Bacon	½ lb. salt pork
4 lbs.	Potatoes	
6 bunches	Carrots	
6 bunches	Celery	All green Pascal-type, if available
1 lb.	Onions	
14 lbs.	Apples	Tart apples such as Greenings
1 med.-size	Lemon	
1 lb.	Coffee	
2 oz.	Tea	
5 lb.	Sugar	
1 oz.	Ground cinnamon	
4 2-lb. loaves	Whole wheat bread	May use rolls if available
1½ pts.	Mayonnaise	
5 qts. 4 46-oz. cans	Grape juice Grapefruit juice	May substitute other available fruit juice or tomato juice
1 #10 can	Whole-kernel corn	Cream-style corn

Miscellaneous supplies needed: salt, pepper, bay leaves, flour.

These pictures of a church kitchen illustrate a good arrangement of equipment for efficiency



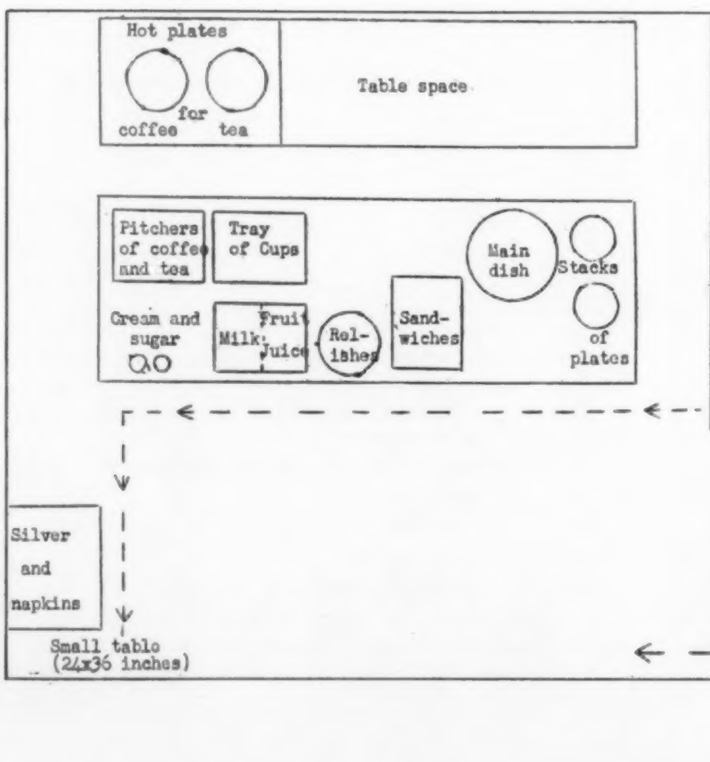
Right—Service unit. Trays can be carried from either the kitchen or dining room side. The soiled dish space at the extreme left of this section has a continuous surface extending from the serving counter. Below—Dishwashing unit

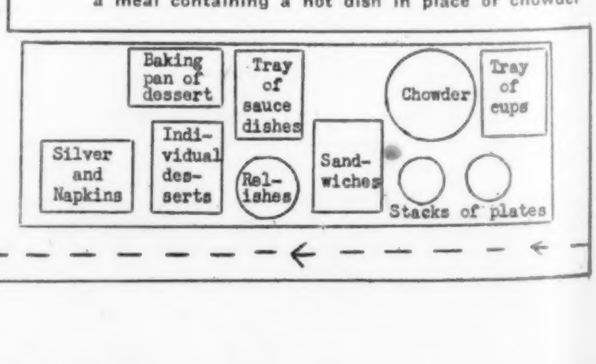


Above—Layout of the church kitchen and serving counter

Below—Diagram 1. An arrangement of the serving table for self-service

Left—Diagram 2. An alternative arrangement for a meal containing a hot dish in place of chowder





information from the emergency file, secure the food, and see that it is delivered to the community building.

II. *Preparing the community building*

The chairman is responsible for getting the community building ready. It is important to have a complete inventory of kitchen and dining room equipment and furnishings including all cooking utensils, silver, dishes, and glasses. Cards listing the items in each cupboard or drawer make it convenient for workers to put things back where they belong. A listing of available workers, hours when they can work, and their telephone numbers is useful when a meal must be prepared and served on short notice.

For an occasional meal, the chairman sees that the floors, working and serving areas, and utensils are clean; that the stove is in good condition, that there is an adequate supply of fuel; and that equipment such as utensils, dishes, silver, glasses, and table covering are on hand or readily available.

The sub-chairman is responsible for the dishwashing and putting the building in order for the next function. She provides for the equipment and supplies for these activities.

If the building is in continuous operation and it is left in good condition each day, a complete daily check will not be necessary.

III. *Other duties of the chairman*

Arrives at the building about a half hour before the workers to start the fire; distributes the food supplies to the areas where they will be prepared, and posts the recipes and job assignments.

Supervises the preparation and the serving and helps with the preparation as needed.

IV. *Other duties of the sub-chairman*

Arrives about one hour before serving time to arrange the dining room and chairs and to help set up the serving table.

During the meal, she helps the guests in the dining room and helps serve the beverages.

V. *Preparation and serving*

It is anticipated that 3 workers, each working from 2 to 2½ hours would be able to prepare this meal. Each worker is responsible for one or two major jobs such as: 1) making the chowder and hot beverages, 2) making the dessert, 3) making sandwiches. They all help with the preliminary preparation such as peeling apples or vegetables and making sandwiches as shown in the chart of job assignments.

VI. *Arrangement of the serving table for self-service* (without the use of trays)

A. Arrange the food in a logical sequence as shown in Diagram 1.

Worker *1* ladles the chowder into cups and places the cup onto the plate which the guest has picked up.

The guest helps himself to sandwiches, relishes, a dish of dessert, silver and a napkin, and passes to the table.

Worker *3* and the sub-chairman pass the beverages, giving the guests a choice.

Worker *2* continues to dish desserts, and supplies food to the serving table from the kitchen.

Pitchers of water and glasses or paper cups should be provided either on the tables or on a side table where the guests may help themselves.

It may be advisable in some places to set up the dining tables with silver, napkins, water glasses, and cream and sugar. Another worker may be required to set the tables.

B. An alternative service

For a meal containing a hot dish in place of the chowder, the serving table may be set up as shown in Diagram 2.

Worker *1* serves the main dish and passes the plate to the guest.

The guest helps himself to sandwiches and relishes. If he chooses fruit juice or milk, he helps himself and then passes to the side table for silver and a napkin. If he chooses a hot beverage, worker *3* pours a cup and hands it to him; he then helps himself to sugar

CHART OF JOB ASSIGNMENTS

Steps in Preparation	Workers *1*, *2*, and *3*
Put eggs on to hard cook	*3*
Peel and slice apples	*1*, *2*, *3*
Finish making and bake dessert	*2*
Peel potatoes and onions and cube bacon	*1*, *3*
Make the chowder	*1*
Make sandwich filling and prepare bread and butter for sandwich making	*2*, *3*
Wash and cut relishes	*2*, *3*
Make sandwiches	*1*, *2*, *3**
Make coffee and tea	*1*
Set up serving table	*2*, *3*
All help with the serving	

* As time permits.

Courtesy of General Foods

APPROXIMATE MEASURE FOR FIFTY SANDWICHES

Item	Amount for Two Sandwiches	Amount for Fifty Sandwiches
Butter	1½ tsp. for 1 slice	10–12 oz. (1¼–1½ cups) for spreading one slice of the sandwich (two times for both). For whole grain bread, use ½ cup more for each 50 slices of bread.
Bread	2 slices	3 pullman loaves (100 slices). 2-lb. pullman loaf, 14 in. long, cuts 35 ⅜-in. slices.
Mayonnaise	2 to 3 tsp.	2 to 3 cups
Mixed fillings	3 tbs. or 1 No. 24 scoop 2 tbs. or 1 No. 30 scoop (for sweet fillings)	2½ to 3 qts. 1¾ to 2 qts.
Sliced meat and cheese	1½ oz. clear meat 1 to 1½ oz. cheese	5 lbs. (10 slices per lb.) 3–4 lbs. (12 to 16 slices per lb.)
Peanut butter	2 tbs.	4 lbs. or 7 cups (1 lb. equals 1¾ cups)
Lettuce	1 small or ½ large leaf	2½–3 heads

EQUIPMENT FOR PREPARING AND SERVING A SIMPLE MEAL TO 150 PERSONS FROM A MOBILE KITCHEN

(Approximate Cost $285.00)

Preparing and serving equipment needed for menu:

For the corn chowder:
- 1 double-boiler, 16-qt., or 2 8-qt. ones. They may be improvised as setting one kettle in another partly filled with water.
- 1 kettle, about 10-qt. capacity
- 1 frying pan, 12- to 16-in. or 2 smaller ones

For sandwiches:
- 1 bowl for filling
- 1 container for creaming butter (Refer to sandwich-making demonstration for other equipment)

For apple crisp:
- 2 baking pans, 12 by 18 in. or equivalent sizes

For coffee:
- 1 kettle or pot, 3-gal. (Refer to coffee-making demonstration for other equipment)

General preparing and serving equipment needed:

Bakers' stoves equipped for Propane gas	2
Coffee makers, 4- to 6-gal. Dripolator type, boilers or stock pots	2
Thermos containers, 5-gal. (optional)	1
Stock pot, 10- to 14-gal. with straight sides	1
Dishpans, 18-in. (square galvanized tubs)	2
Milk cans	
10-gal. for carrying prepared food	2
5-gal, for carrying water	2
Sauce pans, graduated for dipping and measuring	
1-qt.	1
2-qt.	1
Frying pans	
14-in.	1
8-in.	1
Water pail, 3-gal.	1
Mixing bowls	
4-qt.	1
9-qt.	1
Colander, 13-in.	1
Fine strainer, 8-in.	1
Batter bucket, covered for coffee, 1-gal.	2
Measuring spoons	2 sets
Knives, chopping	2
butcher	1
paring	2
spatula, 8 to 10 in.	2
Knife sharpener	1
Food chopper	1
Griddle, 14 in. by 18 in.	1
Can opener, stationary	1
Spoons for basting	
14 to 17 in.	2
Slotted for serving	1
Cook's fork, 12 to 16 in.	1
Pancake turners	2
Wire whip, 16 in.	1
Vegetable brushes	2
Trays, 14 in. by 18 in.	6 to 12
Ladles, 14-in	
1 cup	2
5 oz.	1
Dippers	
No. 12	2
No. 24	1
Dessert spoons, forks, plates	
10-oz. cups	150 of each
Salt and pepper shakers	3 pairs
Sugar shakers, 10 to 12 oz.	4 to 6
Teapots, 1-qt. for cream	2

Cleaning equipment

Broom, short-handled scrub brush, soap powder, dish towels and cloths, hand towels, wash basin, soap, sterilizing compounds.

Other equipment

Axe, shovel, fire extinguisher, first-aid kit, shears, pot holders, flashlight, covered garbage can, bread box or 50-lb. lard cans, coconut or 10-lb. marshmallow cans, grates for open fireplace, stools, flares, blanket or burlap bag for fires, matches

RECIPES FOR EMERGENCY MEAL

A. Corn Chowder

Yield: 50 servings
Size of serving: 1 measuring cup
Approx. cost per serving: $0.036

2 gals.	Milk
2 only	Bay leaves
½ cup (4 oz.)	Butter
1 cup (4 oz.)	Flour
¾ lb.	Salt pork or bacon, diced
2 cups	Onion, chopped
2 qts.	Potatoes, diced
3¼ qts. (1 can, #10)	Corn, whole-kernel
4 tbs.	Salt
¼ tsp.	Pepper

1. Heat the milk with the bay leaves; remove the bay leaves.
2. Melt the fat and stir in the flour; add this to the hot milk and cook until slightly thickened, stirring constantly with a wire whip.
3. Brown the pork or bacon, drain off the fat and cook the onions in it. The crisp bacon or pork may be used to garnish the servings of chowder. Combine potatoes with above ingredients and cook in water to cover.
4. Drain the corn and chop slightly; add the liquid to the thickened milk. Combine with other ingredients. Serve very hot.

B. Relishes (Fresh firm tomatoes cut in wedges make a nice addition if they are in season.)

Yield: 50 servings
Size of serving: 1 stalk celery, ½ carrot
Approx. cost per serving: $0.018

6 bunches	Celery
6 lbs. or bunches	Carrots

1. Separate celery stalks by cutting off root end. Wash thoroughly in cold water, using vegetable brush. Cut outside stalks into desired lengths. Halve or quarter celery hearts by splitting lengthwise with a sharp knife. Wrap in clean damp towel and refrigerate.
2. Remove carrot tops; scrub carrots thoroughly with a vegetable brush; peel if necessary. Halve or quarter carrots by splitting lengthwise. Wrap in clean, damp towel and refrigerate.

C. Chopped Egg Sandwiches

Yield: 50 sandwiches
Approx. cost per sandwich: $0.058

Base for 50 sandwiches:

100 slices	Whole wheat bread
10 to 12 oz. (1¼ to 1½ cups)	Butter

Egg and mayonnaise filling:

3½ doz.	Eggs, hard-cooked chopped
2½ to 3 cups	Mayonnaise
½ cup	Lemon juice
to taste	Salt and pepper

1. Cream butter
2. Cook eggs in water just below boiling point allowing 25 minutes; cover with cold water; remove shells and chop eggs.
3. Combine with mayonnaise, lemon juice and seasoning.

D. Apple Crisp

Yield: 50 servings
Size of serving: ¾ cup
Approx. cost per serving: $0.03

10 qts.	Apples, sliced
3 tbs.	Cinnamon
5 cups	Water
2 qts.	Sugar
6 cups	Flour, all-purpose
2½ cups	Butter

1. Divide the apples into buttered baking pans.
2. Mix the cinnamon and water and pour the mixture over the apples.
3. Work the sugar, flour and butter with the finger tips until crumbly; then sprinkle the mixture over the apples. Bake the mixture in a hot oven (450° F.) for 5 minutes; then lower the temperature to 400° F. and bake for 25 to 35 minutes or until the apples are tender. Serve warm.

E. Coffee

Yield: 50 cups
Size of serving: ¾ measuring cup
Approx. cost per serving with cream and sugar: $0.017

1 lb.	Coffee
2½ gals.	Water, boiling

For drip coffee made in a dripolator urn or stock pot:

1. Place the coffee (drip grind) in a basket or a bag.
2. Pour the boiling water over it slowly. When all the water has been poured over, pour through again half the brew to give more strength and a fuller flavor. Establish a repouring procedure suited to the kind and grind of coffee, to the equipment used, and to the strength desired.
3. Remove the grounds as soon as the water has dripped through.

For brewed coffee made in a large coffee pot, kettle or stock pot:

1. Mix the coarsely ground coffee with egg and shell (one egg for 1 pound of coffee); place the mixture in muslin or cheese cloth bags and tie them loosely enough to allow for the swelling of the coffee grounds.
2. Place the bags into the boiling water and cover the utensil; regulate the heat so that the coffee will be just below the boiling point and will simmer until the desired strength is obtained. (About 20 minutes).
3. Remove the bags, cover the coffee, and keep it hot for serving.

F. Tea

Yield: 50 cups
Size of serving: ¾ measuring cup
Approx. cost per serving: $0.007

2 oz.	Tea, black
2½ gals.	Water, boiling

1. Tie tea loosely in a cheese cloth bag; place in suitable container. Pots or containers of earthenware, heat-resistant glass, china and unchipped enamel are all satisfactory for making tea.
2. Pour actively boiling water over tea. Remove tea bag at the end of 3 minutes.

G. Fruit Juice

Yield: 50 servings
Size of serving: ¾ measuring cup
Approx. cost per serving: $0.038

5 qts.	Grape juice
5 qts.	Grapefruit juice

1. Chill the juices in their original containers by placing in the refrigerator, for several hours before serving. If necessary, the mixture may be chilled by pouring over clean cracked ice, but this method will dilute the juices.
2. Combine the grape and grapefruit juices just before serving time.

MEAL COST SUMMARY

Ingredient	Cost per Serving
Corn chowder	$0.036
Raw carrot and celery	0.018
Chopped egg sandwich	0.058
Apple crisp	0.03
Coffee	0.017
	$0.159

Cost of meal serving tea as the only beverage..... $0.149
Cost of meal serving fruit juice as the only beverage $0.18
Cost of meal serving-one-third of guests coffee, one-third tea, and one-third fruit juice......... $0.163

INGREDIENTS NEEDED AND THEIR COST

A. Corn Chowder: total cost, $1.799; cost per serving, $0.036

Amount		Ingredient	Unit Cost	Cost of Amount Used	Weight, Measure, Equivalent
Measure	Weight				
2 gals.		milk	$0.36	$0.72	1 gal. = 4 qts.
2 only		bay leaves			
½ cup	¼ lb.	butter	.40	.10	1 lb. = 2 cups butter
1 cup	¼ lb.	flour	.038	.01	1 lb. = 4 cups flour
	¾ lb.	bacon	.27	.20	
2 cups	1 lb.	onion, chopped	.04	.04	1 lb. = 4 to 6 onions
3½ qts.	(1 #10 can)	corn, whole-kernel	.575	.575	
2 qts.	4 lbs. as purchased	potatoes, diced	.036	.144	1 lb unpeeled potatoes = 2 cups, peeled and diced
4 tbs.	2 ozs.	salt	.029	.01	1 lb. = 2 cups salt
¼ tsp.		pepper	.14		1 lb. = 4 cups pepper

B. Relishes: total cost, $.885; cost per serving, $.018

6 bunches	6 lbs.	carrots	.0375	.225	1 lb. = 4 medium carrots
6 bunches	6 lbs.	celery	.11	.66	1 lb. = 8 to 10 stalks

C. Chopped Egg Sandwiches on Whole Wheat Bread: total cost, $2.906; cost per serving, $0.058

100 slices	4 2-lb. loaves	bread, whole wheat	.20	.80	1 2-lb. sandwich loaf cuts 28 medium slices
	1½ lb.	butter	.40	.60	1 lb. = 2 cups butter
3½ doz.		eggs	.35	1.23	
¼ cup	1 lemon	lemon juice	doz. .26	.021	1 medium-sized lemon (300) yields ¼ cup juice
3 cups		mayonnaise	qt. .336	.255	1 qt. = 4 cups
To taste		salt and pepper			

INGREDIENTS NEEDED AND THEIR COST—*Continued*

D. Apple Crisp: total cost, $1.5885; cost per serving $0.03

Amount		Ingredient	Unit Cost	Cost of Amount Used	Weight, Measure, Equivalent
Measure	Weight				
10 qts.	14 lbs.	apples	$0.06	$0.84	1 lb. apples before peeling = about 3 cups sliced
3 tbs.		cinnamon	lb. .35	.0175	1 oz. = 4 tbs. cinnamon
2 qts.	4 lbs.	sugar	.056	.224	1 lb. = 2¼ cups sugar
6 cups	1½ lbs.	flour	.038	.057	1 lb. = 4 cups flour
2¼ cups	1⅛ lbs.	butter	.40	.45	1 lb. = 2 cups butter

E. Coffee: total cost, $.856; cost per serving, $.017

	1 lb.	coffee	.30	.30	1 lb. = 5 cups coffee
1¼ qts.		cream, 20%	qt. .40	.50	1 qt. = 4 cups cream
	1 lb.	sugar	.056	.056	1 lb. = 2¼ cups sugar

F. Tea: total cost, $.356; cost per serving, $.007

¾ cup	2 ozs.	tea	.10 per 2 oz. bag	.10	1 lb. = 6 cups tea
1 pt.		cream, 20%	.40 qt.	.20	1 pt. = 2 cups cream
	1 lb.	sugar	.056	.056	1 lb. = 2¼ cups sugar

G. Fruit Juice: total cost, $1.905; cost per serving, $0.038

5 qts.		grape juice	.237 qt.	1.185	
5 qts.	(3⅓ cans)	grapefruit juice	.216 per can	.72	1 45-oz. can measures approximately 1⅓ qts. grapefruit juice.

and cream. He passes to the side table for silver and a napkin.

To speed the service for a large group, a worker may be stationed at the side table to give each guest silver and a napkin; the silver may be wrapped in the napkin.

The dessert in individual dishes may be placed on a table apart from the main serving table where the guests may come back and help themselves without interrupting the main service, or it may be put on the tables at each place before the meal is served.

Pitchers of water and glasses or paper cups should be provided.

VII. *Keeping foods hot for serving*

Foods may be kept hot by direct heat or by insulation. For direct heat, an electric or gas plate or an oil stove may be used. The heat should be kept low or foods should be held over hot water in a double boiler or they should be set in a pan of hot water over the heat. In kitchens where the range is near the serving area, the hot food can be served onto the plates directly from the range. Food can be kept hot for a considerable time if held in an insulated container. Such a container may be ready-built or one may be improvised by sur-

rounding the container of food with tightly crushed newspaper, with excelsior, or with loosely packed sawdust bags. The container should be hot when the food is put into it, the food itself should be hot when packed, and the container should be kept tightly covered until used. The cover should be replaced for any period when food is not being served.

If neither insulation nor direct heat is available, food should be placed in heated heavy containers and kept covered until used. Mixtures in deep containers keep warm longer than individual pieces of food in flat pans; such food should be replaced frequently from the range and served quickly.

VIII. *Follow-up service*

One worker helps the sub-chairman; she arrives during the meal, and as soon as the guests leave, she helps clear the soiled dishes; in some emergencies, the guest may each return his own dishes to the kitchen.

The sub-chairman and her helper clean the floor, dispose of the garbage, arrange for laundering of the dish towels and put the place in order.

IX. *Records*

Records are needed in order to know the actual cost of serving the meal and to record information for future use.

Receipted bills should be obtained with all purchases and filed, in case they are required for reimbursement of money spent.

The following information should be recorded:

- Date
- Place
- Type of meal
- Estimated number of persons to be served (include workers who receive their meals)
- Actual number of persons served (include workers)
- Recipes and cost (a 4- by 6-in. card may be used for each recipe to record the ingredients, the amount of the ingredient, the unit price and cost of each ingredient, the total cost of the recipe, the manipulation and number and size of servings).
- Amount of food left over.
- Suggestions for improvement.
- The other necessary information may be recorded as shown on the financial report form.

FORM FOR FINANCIAL REPORT

List of Purchases		Unit Cost	Total Cost
Miscellaneous foods such as flour and condiments			
Total cost of food			
Other expenses			
Labor			
Supplies			
Total			
Total cost of meal			

PROLONGING THE LIFE OF FOOD SERVICE EQUIPMENT

By MABELLE S. EHLERS

Head, Department of Institution Administration, Michigan State College of Agriculture and Applied Science, Lansing

THE years of 1941-43 will long be remembered by operators of school cafeterias and dormitories as a period of adjustment to a new situation with regard to equipment.

Good Quality Equipment Used in Schools

School food service operators in contrast to commercial operators, have been prone to buy superior equipment. There is sound reasoning back of such purchasing. Commercial operators often do not own the buildings which they occupy; and while equipment can be moved, the effects of moving are sometimes disastrous. Old equipment that seems perfectly usable, with a prospective life of several additional years, has often ceased to function after being moved from one building to another. A thousand and one mishaps may befall it in the process of being uprooted and relocated. Hence commercial operators who do not own their premises have frequently bought the cheapest equipment available that would operate with any degree of efficiency.

Since school cafeterias and dormitories, on the other hand, are usually permanently domiciled, equipment could live out its useful life in one spot; thus the best equipment, from the standpoint of superior materials and construction, has been bought. This has meant the use of monel metal or stainless steel in increasing quantities, the stainless steel being used not only for machines but for utensils as well. If the utensils were of material other than stainless steel, they were likely to be of aluminum; except in the bakeshop, where nothing better than tin has been found for cake, pie, muffin, and bread pans.

So, too, these school operators, in their quest for long-wearing and attractive silver, bought that which was plated on heavy blanks of 18% nickel silver. It wore well, it did not bend, and it did not rust. Kitchen knives were apt to be of superior steel, frequently the imported Henkel steel.

Monel metal, stainless steel, aluminum, tin, nickel silver, high-carbon steel, are all unobtainable now.

"Priorities will take care of us," thought many a school operator, not realizing at first that a priority number merely gives one a preferred place in the customers' lineup—if the material is all gone before your turn comes, it is just as much gone as if it had never been there in the first place.

Thus we must extend the life of the equipment which we now have, and be willing to accept substitutes for materials no longer obtainable.

Use of Substitutes, If Substitutes Can Be Found

For some equipment, no satisfactory substitutes have as yet been found.

Monel metal or stainless steel in dishwashers, steam tables, and sinks could be replaced by galvanized iron; but because of the scarcity of zinc, galvanized iron cannot be used. Since there are no other satisfactory materials for these pieces, the equipment already in use must last for the duration of the war.

Monel and stainless steel were also used for table tops and counters. The materials are replaceable in this case. The writer has long preferred wood for kitchen table tops, for it is less noisy than metal, and there is something attractive about the appearance of well-scrubbed wood. It must *be* well scrubbed, however; nothing looks worse than a wooden table covered with grease spots. It must also present an unmarred surface—cooks must not cut directly on the tables. Cutting boards are cheap and should be supplied to all workers who cut vegetables or fruit or meat. The meat cutter, if enough meat is used to warrant employing such a person, will have his meat block on which cutting is done directly, but for cutting small amounts of raw or cooked meat, a board should always be provided. Even if the operator has metal-topped tables, boards still should be used; for the metal will dull those knives of which we must be so careful since their good steel is not available.

These wood work tables should have metal legs,

Courtesy S. Blickman, Inc.

The cafeteria counter in Slocum Hall, Syracuse University, exemplifies the type of high-grade stainless steel equipment for cafeterias and dining hall kitchens schools used to buy

Courtesy S. Blickman, Inc.

Tables with laminated wood tops are serviceable and look well. These pre-war tables in the cafeteria bakery of the College of Home Economics at Cornell University have stainless steel legs

preferably of galvanized iron pipe; but if metal is not to be had, heavy wooden legs can be used. The tops should be laminated and put together with casein glue.

For cafeteria counter tops, wood is not quite so satisfactory. Since these counters must be scrubbed, varnish is a bad finish for them. They should either be left unfinished and scrubbed white, or painted with an enamel finish. The writer knows of a cafeteria counter which was added to several times. It now consists partly of glass, partly of wood, and partly of metal. The metal and the wood parts were enameled black to match the glass, which was the original counter. It is very difficult to distinguish the different materials from each other, such an excellent job of enameling was done, the whole presenting a very neat and satisfactory appearance. Glass and plastic are also possibilities for cafeteria counters, though since plastic is being used for war purposes, it may not be available.

There are as yet no substitutes for the materials in power-driven potato peelers, choppers, grinders, mixers, and the like. These pieces, like the dish washing machines and steam tables, must be conserved.

Substitutes can be obtained for stainless steel and aluminum utensils. If proper care is taken of enameled ware, it should give good service. Employees must be taught not to strike serving spoons or forks against these utensils lest chipping occur. These utensils consist of glass-coated iron or steel. When the glass coating is broken, the iron is exposed and eventually is eaten through by rust. The appearance is, of course, unsightly just as soon as the coating is broken. These utensils should never be allowed to boil dry nor be subjected to fierce, sudden heating.

Glass may be substituted for metal utensils in the home, but it has never been widely accepted by institution operators. Glass custard cups and even small glass casseroles for individual service have been used to some extent; but that is about as far as their use has gone. Even though glass is available, it will probably not be used for large quantity cooking.

Baking tins must be conserved, for enamelware is not particularly satisfactory for cake pans, pie pans, and the like.

Coffee urns are among the items for which no acceptable substitutes have been found. The outer jackets have been made of nickel-coated copper or stainless steel, both unavailable—and enameled iron is not well-adapted to this purpose. The liners of glass or earthenware, of course, are still available.

If the coffee urns break down completely, glass coffee makers can be resorted to. As a matter of fact, they produce very good coffee. The upper chamber as well as the lower, however, should be of glass, since coffee should not come in contact with metal.

China and glass are still plentiful, although there is a possibility of color shortages, and some patterns in china may no longer be had.

A low-carbon steel base is being used for table silver instead of the unobtainable nickel silver base, but since it rusts easily it must have special care. Carbon steel is also used in place of stainless steel for blades; and that, too, needs special care.

Proper Care of Irreplaceable Items

Prolonging the life of irreplaceable items should be of the utmost concern to any food service operator. There are many ways of doing so.

1. Correct Operation of Equipment.—Power mixers should be started out at low speed; potato peelers

Courtesy Southern Equipment Co.

Kitchen, Currier Hall, University of Iowa. The salad worker at left is cutting on a wooden board to save the top of the table. Steamers such as those at right are irreplaceable and must be well-cared for. The power mixer at the right of the steamers also merits the greatest of care

should not be overloaded; utensils should not boil dry; urn jackets should be filled with water before the heat is turned on, and so on. Many an operator assumes that equipment is being operated and maintained correctly because instruction has been given, when such may not be the case. Inspection is required to see that instructions are being carried out.

2. Immediate Repair and Replacement.—Repairs of even a minor nature should be made immediately, and worn parts should be replaced at once, if such replacements are obtainable. The old adage, "a stitch in time saves nine," was never more meaningful than today—in fact, repairs and replacements in time may save the whole machine. Inspection to reveal the need for repairs and replacements should be made at frequent intervals, especially if the equipment is old.

3. Generous Use of Oil.—Inexperienced operators frequently do not realize the importance of lubricating all moving parts. A search should be made for oil holes and grease cups on all pieces of equipment. If there is a maintenance man employed by the institution it may be his duty to oil and grease equipment; but he, as well as the food service manager, may not be too expert at this work. Equipment salesmen may be consulted if they are still making their accustomed calls. If not, the manufacturers should be consulted. As a rule, they will gladly furnish diagrams and charts showing the construction of the equipment with directions for oiling.

4. Protection from Rust and Corrosion.—Legs and framework of all kinds, whether of galvanized iron, cast iron, or wood, should be painted and kept painted. Sectional steamers and vats are particularly prone to rusting because they are wet most of the time. They can be painted inside and out with aluminum paint mixed with waterlox, to help keep them rust-free. Liquid containing alkali or alkaline waters should not be permitted to stand in aluminum jacketed kettles or in any aluminum utensil.

5. Complete Cleanliness.—Thorough washing with soap and a detergent seldom harms anything; and all foreign matter must be removed if equipment is really clean. That means the removal of lime from dishwashing machines, steam tables, and coffee urns. Drastic methods of removal, however, may result in pitting of the metal, which is eventually followed by holes. Carbon should be removed from ovens, ranges, and pipes. Rust should be removed. If the rusting has left the metal rough after its removal with oil or kerosene, it may be smoothed down with sandpaper or steel wool, the spot re-oiled or greased with any salt-free grease, and the surplus wiped off.

6. Thorough Drying after Cleaning.—This is particularly important for dishwashing machines, sinks, steam tables, steamers, mixer bowls, choppers, and grinders. In many kitchens these pieces are seldom dried after cleaning. It is small wonder that rusting or other corrosion occurs.

7. Protection of Certain Materials from Extreme Heat.—One item which heat affects disastrously is the plastic tray so well liked by cafeteria patrons. These trays are impossible to obtain without a high priority number. They can be washed in dishwashing machines, provided their journey through does not exceed five minutes. They should never be set on the range, of course, though some careless individual may do just that.

8. Conservation of Silverware.—Silver flatware represents a considerable investment of money; and since it can not be replaced except with sterling (which is out of the question for most operators) or with the new low-carbon steel-base ware, it is particularly important to keep it in condition. Tines of forks can be straightened so that these items are usable again. Re-plating can be done. If one must buy new flatware, the manufacturer's instructions for its care should be followed to the letter. They stress the importance of drying thoroughly after washing, of not permitting the silver to stand in liquids of any kind, and of storage in a dry place.

9. Conservation of Cutlery.—Cutlery should be kept sharp and properly pointed and rust-free. Manufacturers suggest that non-stainless steel blades should, like the new silver flatware, be dried thoroughly after using; that they should not be left standing in water or other liquids; and that they should be stored in a dry place. Blades should be stropped daily on a "leather board," unless one has so many of them that a mechanical sharpener should be used. Broken blades can be repointed and the knives made usable again.

Courtesy Southern Equipment Co.

The ranges in the Currier Hall kitchen are sturdy and long-lived. They are treated with care and kept clean and rust-free

Guarding Against Losses of Small Equipment

Prevention of losses of small equipment is perhaps as important as proper care and maintenance. In the main, losses are due to three things: breakage of china and glass, removal along with garbage, and theft.

Improper stacking of trays; improper sorting of items on the soiled-dish table; a too-large accumulation there before starting the washing process; insufficient space on the cleared dish table; failure to remove the items from this space rapidly enough; nesting of glasses and cups—all of these procedures result in excessive breakage. Too much traffic in the vicinity of the dishwashing machine and absence of small peephole windows in service doors frequently cause collisions, with resultant breakage.

Many small items, such as paring knives, salt and pepper shakers, ash trays, butter chips, and silver frequently go out in the garbage. The opening in the soiled-dish table over the space for the garbage can should always be protected by a swilling block. In some places, a pre-flushing sink is set into the soiled-

dish table. This sink contains a basket which receives the garbage; and items other than garbage are said to be easy to recover. In many institutions the garbage is spread out and raked over a drain. It is also possible to recover from the garbage haulers these small pieces of equipment, the loss of which may amount to quite a sizeable sum.

The control of theft is often a difficult management problem. Theft by customers may be harder to control than theft by employees. Locked storage cupboards for china, glass, and silver help to some extent. Inventory taking at frequent intervals has a psychological effect that may prevent losses of silver especially. Since customer thieving is often due to the souvenir-collecting habit, the absence of a name or initials or crest will make the pieces less attractive as souvenirs. Many dormitory operators find that by checking the rooms as soon as the residents leave for vacation or immediately before, items such as tumblers, knives, spoons, and salt shakers are recovered in appreciable numbers.

The best means for conserving equipment and preventing losses may lie in securing the cooperation of employees and clientele. If they knew more about the cost of equipment and of the impossibility of replacing most of it, they might conceivably treat it with more respect. To that end some operators have carried on a campaign for cooperation. Meetings of employees are held at which the situation is explained to them, usually by some visual means. They are asked to sign a pledge to save water, electricity, materials, and so forth; and are given buttons to wear with some such phrase inscribed thereon as "I Save for Uncle Sam." The realization that they are actually aiding in the war effort by so doing has proven to be a strong incentive.

Posters are placed in strategic positions in every department indicating how materials there, including equipment, can be saved or conserved. Similar posters are displayed where customers will see them. Menus sometimes carry the message.

Since anything that can be done to prolong the life of equipment is constructively patriotic, operators, too, should feel that by the use of these or any other conservation measures they are definitely aiding in the war effort.

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EST. 1889

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Automatic Electric Hot Food Storage Tables	Dish Heaters	Pantry Cabinets and Cupboards	Storage Bins and Closets
Bain Maries	Dish Tables	Plate Warmers	Tray Trucks
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Cereal Cookers	Food Conveyors	Service Units	Warmers
Coffee Urns	Food Trucks	Sinks	Water Coolers
Cooks Tables	Kitchen Cabinets	Steam Tables	Work Tables
	Pan and Pot Racks		

Special equipment built to specifications

All orders subject to current Government priority regulations

Cafeteria counter, Syracuse University—Plate No. 1582

TYPICAL INSTALLATIONS

Cornell University, Ithaca, N. Y.
Columbia University, New York, N. Y.
Syracuse University, Syracuse, N. Y.
University of North Carolina, Chapel Hill
Vassar College, Poughkeepsie, N. Y.
Virginia Polytechnic Institute, Blacksburg
Hershey (Pa.) Industrial High School
Bayonne Senior High School, Bayonne, N. J.
High School for Needle Trades, N. Y. City
Suffern Grade School, Suffern, N. Y.
City of Washington, D. C.—15 schools
City of Philadelphia, Pa.—5 schools

U. S. Government: Numerous installations in camps, cantonments, Naval and Marine Corps stations. Also galley equipment for the Navy and Maritime Commission.

A modern kitchen installation by S. Blickman, Inc. The Stainless Steel equipment assures permanence, sanitation and ease of cleaning. Note the rolled edges, fully-rounded corners and coves and smooth, permanently-bright, attractive surfaces. Plate No. 1506

MODERNIZING INADEQUATE FACILITIES FOR EFFICIENT SERVICE

BEFORE: Cafeteria at Johnson Hall, Columbia University, before re-design. Note U-shaped counter and the two building columns "A" and "B" in front of it, obstructing traffic.

AFTER: View of same room after re-planning by Blickman engineers. Note the clean design and orderly arrangement and how building columns "A" and "B" have been relegated to a position in work space behind counter. Blickman Stainless Steel equipment was used throughout the installation.

● We help school administrators and dietitians modernize cafeteries, etc., to meet the demands of expanded patronage. This example illustrates how one of America's leading universities streamlined for serving 2000 meals a day.

The Problem: In the cafeteria at Johnson Hall, Columbia University, traffic was slow around U-shaped counter. Aisles were congested and building columns protruding in front of counter further obstructed traffic. How was service to be speeded up without using more floor space? How was provision to be made for combining self-service during breakfast and luncheon, and table service for dinner?

The Solution: Blickman Engineers found that by reversing the entire floor plan and establishing the traffic aisle in the work space behind the original counter, they could make these improvements: (1) Design a straight counter, eliminating bends and speeding up flow of traffic. (2) Increase effective counter length and capacity. (3) Relegate the building columns to the work space behind the counter, entirely out of the way of traffic.

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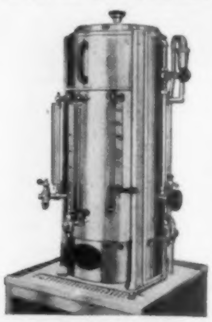

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Also general purpose, scullery and dish washing sinks; food conveyors; counters; gas electric combination units with food and plate warming sections; hot food storage and refrigeration units.

Cafeteria at Casey Jones School of Aeronautics, the largest school of its kind. Cafeteria under Howard Johnson Management. Equipment designed and installed by Ershler & Krukin, Inc.

The Casey Jones School of Aeronautics is a good example of wartime planning by the operator and kitchen equipment manufacturer. This installation is constructed of non-critical material yet so well designed that it will stand up for years under the 24-hour service to which it is being subjected. Many schools now converting to wartime training activities have this same problem . . . a problem calling for expert planning and high manufacturing skill. We supply both and will be glad to discuss your problem with you.

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High school cafeteria counter and food service equipment by Ershler & Krukin, Inc.

Main kitchen; showing equipment designed and constructed by Ershler & Krukin, Inc.

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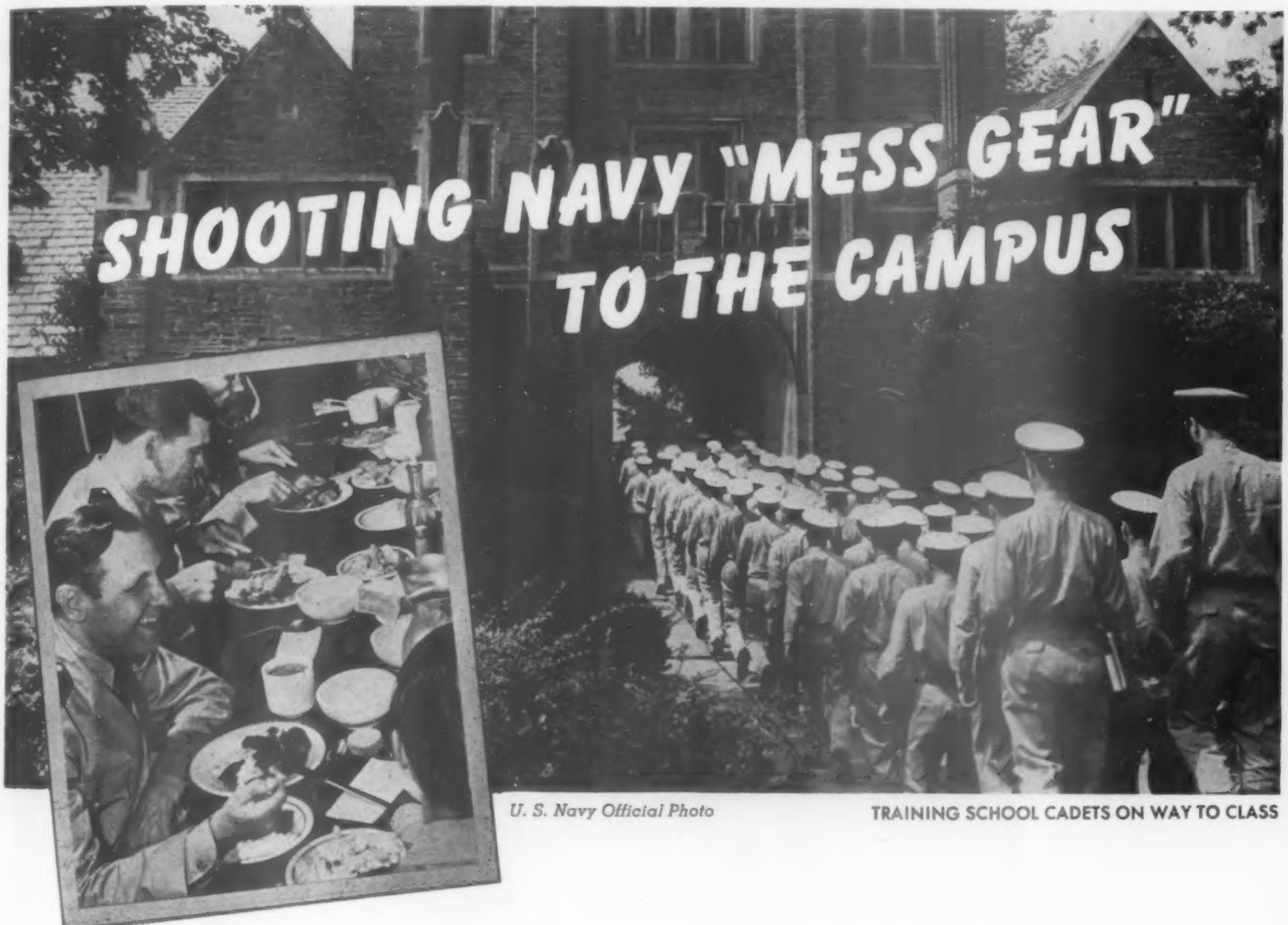

U. S. Navy Official Photo

TRAINING SCHOOL CADETS ON WAY TO CLASS

NOT all of Uncle Sam's naval battles take place on warships. On many campuses, U. S. Naval Training Schools are fighting against time to turn recruits into officers.

At a number of these schools, DUPARQUET engineers have already been in there doing a job. Quickly enlarging cooking and serving layouts — often tripling peacetime facilities. When a school's enrollment suddenly soars from 500 to around 2,000 it calls for more of everything—"mess gear" (china, glass and silver to us landlubbers); batteries of steamers, double jacketed kettles, coffee urns—all in A1 working order. This means installations to save fuel consumption, operating time, repairs. For in war or peacetime, you can *count* on DUPARQUET equipment to keep efficiency up, replacements down.

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Service Section View—Texas A. & M. College

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Canopies
Bain Maries
Steam Tables
Refrigerators
Coffee Urns
Urn Stands
Urn Trays
Work Tables
Display Stands
Plate Warmers
Guard Rails
Back Bars
Cereal Cookers
Floor Coolers
Water Coolers
Food Conveyors
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Dish Trucks
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Double Service Cafeteria Counter, Lincoln High School, Lincoln, Nebraska

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University of Arkansas...Fayetteville, Ark.
Arkansas State College..Jonesboro, Arkansas
Pulaski Heights High School
Little Rock, Ark.
Western State College...Gunnison, Colorado
St. Patrick's School..Miami Beach, Florida
University of Georgia (Naval Preflight School) ....Athens, Georgia
Bloomington High School..Bloomington, Ill.
The Principia..............Elsah, Illinois
Scott Hall Dormitory.........Evanston, Ill.
Springfield High School....Springfield, Ill.
Notre Dame Academy.........Belleville, Ill.
Iowa State College............Ames, Iowa
Univ. of Iowa (Currier Hall).Iowa City, Ia.
St. Mary's Academy....Leavenworth, Kansas
Alexander Hamilton Intermediate School
Wichita, Kansas
Charles Robinson Intermediate School
Wichita, Kansas
University of Kentucky-Student Union Bldg.
Lexington, Kentucky
Dillard University...New Orleans, Louisiana
New Iberia Parish High School
New Iberia, Louisiana
Louisiana State Normal School
Natchitoches, Louisiana
Warren Easton High School.New Orleans, La.
Clayton High School.....Clayton, Missouri
Stephens College (Girls Dormitory)
Columbia, Missouri
Lincoln Univ. (Colored)..Jefferson City, Mo.
Maplewood Senior High School
Maplewood, Missouri
Normandy High School..Normandy, Missouri
Southwest High School...St. Louis, Missouri
Douglas School (Colored)
Webster Groves, Mo.
University of Missouri (Dormitory)
Columbia, Missouri
St. Louis University....St. Louis, Missouri
Missouri School for Deaf...Fulton, Missouri
Central High School....Jackson, Mississippi
Yazoo City High School
Yazoo City, Mississippi
Mississippi State College for Women
Columbus, Mississippi
Vicksburg School.....Vicksburg, Mississippi
Wellesley College (Infirmary)
Wellesley, Mass.
Frostburg High School..Frostburg, Maryland
Allegheny High School.Cumberland, Maryand
Montana State College..Bozeman, Montana
New Senior High School..Billings, Montana
Dominican High School...Detroit, Michigan
Girls Academy (Shrine of Little Flower)
Detroit, Michigan
University of Minnesota..Minneapolis, Minn.
Lincoln High School.....Lincoln, Nebraska
University of Nebraska (Girls Dormitory)
Lincoln, Nebraska
North Platte High School.North Platte, Nebr.
Newark Valley School..Newark Valley, N. Y.
Grover Cleveland High School
New York, N. Y.
Walton High School......New York, N. Y.
Edison Elementary School.Carlsbad, N. Mex.
Bexley Senior High School....Bexley, Ohio
DeVilbiss High School.........Toledo, Ohio
J. D. Robinson Jr. High School.Toledo, Ohio
Ohio State University......Columbus, Ohio
Ohio University..............Athens, Ohio
University of Akron...........Akron, Ohio
Central High School...Oklahoma City, Okla.
Muskogee Schools (2).....Muskogee, Okla.
Dawson School ....Tulsa, Okla.
Cameron Agricultural School..Lawton, Okla.
Bartlesville School.......Bartlesville, Okla.
Polk State School.......Polk, Pennsylvania
Mechanic Arts School...Evansville, Indiana
Purdue University (Men's Dormitory, Women's Dorm.)...Lafayette, Indiana
State Teachers College (Men's Dormitory)............Cape Girardeau, Mo.
Sumner High School......Kansas City, Mo.
Colorado College of Agr. & Mech. Arts
Ft. Collins, Colorado
Tennessee State Teachers College, East
Johnson City, Tenn.
Tennessee Polytechnic Inst..Cookeville, Tenn.
Central High School....Murfreesboro, Tenn.
E. Nashville High School...Nashville, Tenn.
Clarksville School......Nashville, Tennessee
Dyersburg School......Dyersburg, Tennessee
McKinley High School.....Amarillo, Texas
Austin High School.........Austin, Texas
Wynn Seale Jr. High School
Corpus Christi, Texas
Highland Park School.......Dallas, Texas
Lily B. Clayton School...Fort Worth, Texas
North Hi-Mount School..Fort Worth, Texas
Sam Houston State Teachers College
Huntsville, Texas
A. & I. College.........Kingsville, Texas
Laredo High School.........Laredo, Texas
Thomas Jefferson Sr. High School
San Antonio, Texas
S. W. Texas State Teachers College
San Marcus, Texas
Hardin Jr. College....Wichita Falls, Texas
Galveston Jr. High School..Galveston, Texas
Tyler High School...........Tyler, Texas
University of Texas (Men's Dormitory)
Austin, Texas
A. & M. College....College Station, Texas
Ogden High School..........Ogden, Utah
Jordan High School..........Sandy, Utah
Brigham Young Univ...Salt Lake City, Utah
Virginia Polytechnic Inst...Blacksburg, Va.
Phoenix School, Hampton Inst. (Colored)
Hampton, Virginia
St. Vincent's Parochial School
Newport News, Va.
Richmond Public Schools....Richmond, Va.
University of Wyoming—Student Union Bldg. ....Laramie, Wyoming
University of Wyoming—Women's Dormitory ....Laramie, Wyoming

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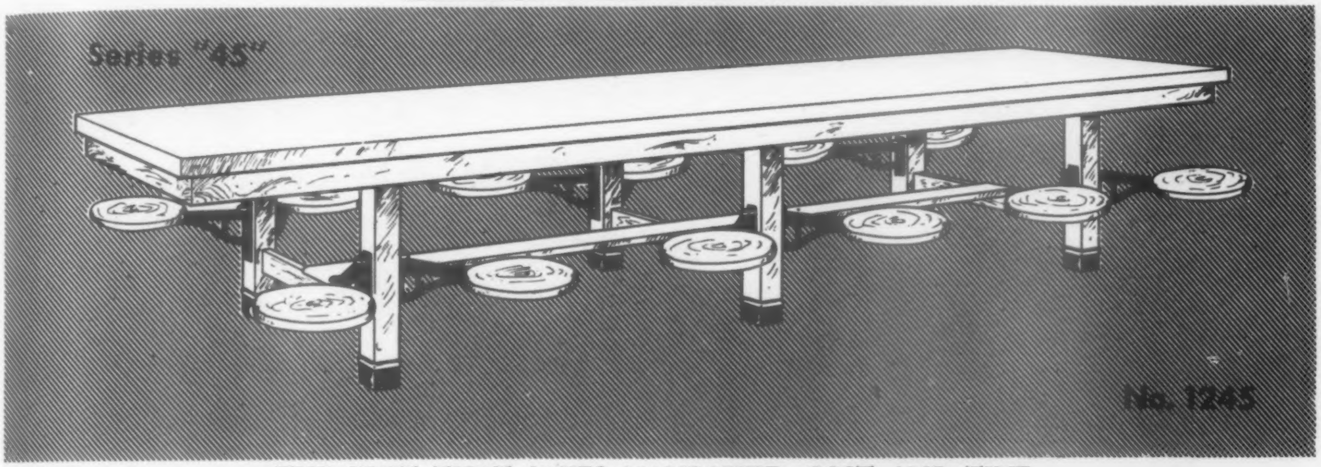

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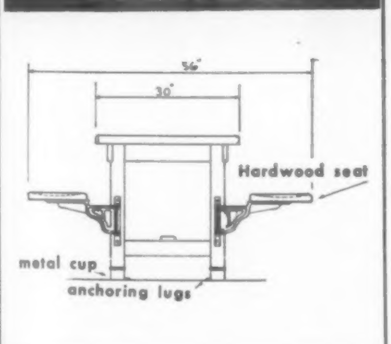
School, industrial and military establishments now using them have found these RIEDER units save floor space and expedite mealtime traffic flow. Built on high standards of construction . . . to enable them to withstand hard, continual usage . . . the tables are the result of 30 years' experience and leadership in designing special-purpose interiors for all types of industrial needs.

SECTION



General Specifications

Constructed of selected, close-grained maple or birch. They are available with 4 to 20 seats per table, in cantilever (illustrated) or regulation styles. This flexibility permits greater seating capacity than with ordinary equipment. Table tops are furnished in hardwood, linoleum, formica, vitreous glass or any other desired material. All tops are 30" wide; tables occupy only 56" in width when seats are extended. The legs are set in metal cups, secured by anchoring lugs. Hardwood seats, shaped for comfort, are mounted in sturdy metal brackets which swing to a position stop.

LIST OF SIZES

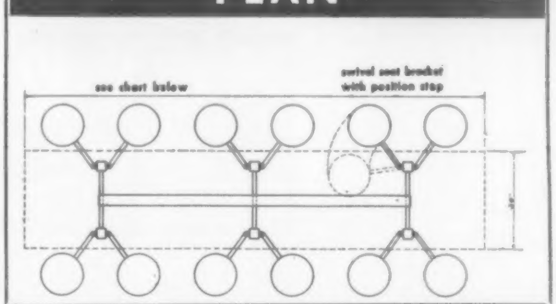
NUMBER	CAPACITY	TOP LENGTH	TOP WIDTH	WIDTH IN USE
445	4 · SEATS	4'·0"	30"	56"
645	6 · SEATS	6'·0"	30"	56"
845	8 · SEATS	8'·0"	30"	56"
1045	10 · SEATS	10'·0"	30"	56"
1245	12 · SEATS	12'·0"	30"	56"
1445	14 · SEATS	14'·0"	30"	56"
1645	16 · SEATS	16'·0"	30"	56"
1845	18 · SEATS	18'·0"	30"	56"
2045	20 · SEATS	20'·0"	30"	56"

TABLES SHIPPED KNOCKED DOWN

Approximate weight 40 lbs. per seat

INQUIRE THROUGH YOUR EQUIPMENT DEALER OR WRITE US DIRECT

PLAN



SCALE ANALYSIS OF YOUR DINING HALL

will be prepared by our engineering Staff on request

SUBMIT DIAGRAM AND NUMBER OF PERSONS PER SITTING

THE G. S. BLODGETT CO., INC.

53 Maple Street, Burlington, Vermont

BLODGETT OVENS . . .

DESIGNED TO FIT DEFENSE DEMANDS and ASSIGNED TO WORK FOR VICTORY!

No. 959 Roaster and Double Baker Oven

Military, Maritime and War Plant orders are taking a large part of our production capacity . . . for the time being and perhaps for the duration. While Blodgett Ovens are helping to feed the Armed Forces, we pledge ourselves to assist every Blodgett Baking and Roasting Oven user to "Keep 'Em Cooking."

Essential civilian oven users may now purchase new Blodgett Ovens under Order L-182. See your dealer or local WPB office.

SERVICE: To get the utmost efficiency from your present Blodgett equipment, be sure to obtain our instruction sheet and list of repair parts. Burners should be kept clean and properly adjusted, flues should be cleaned regularly, and heating surface kept free from foreign matter.

For continued good service, consult your equipment dealer or your gas company service department, or write us direct.

THE G. S. BLODGETT CO., INC.
53 MAPLE STREET, BURLINGTON, VERMONT
BLODGETT—Makers of Fine Ovens Since 1848

THE CLEVELAND RANGE CO.

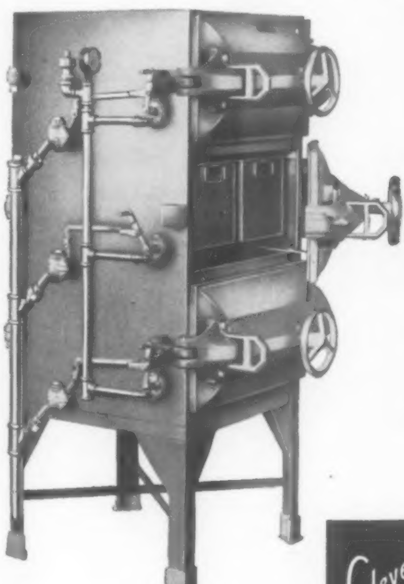
Cleveland, Ohio

STEAM-CHEF STEAM COOKERS

for all School, College and Institution Kitchens. Direct Steam—Gas—Electric Operation

RAPID steam cooking with high initial temperature retards heat-induced destruction of vitamins, and the absence of cooking water reduces losses of soluble vitamins and other vital food elements. The absence of air in the cooking compartments prevents oxidation of vitamins and preserves essential food values. Consequently vegetables and other foods are more nourishing and appetizing when steamed, because many of the retained soluble elements are responsible for flavor as well as nutritive value. In hundreds of leading educational institutions the Steam-Chef saves time, space, work and fuel. It requires no expert help, is always ready for use, frees your range top for other purposes, and can be used for a great variety of foods. The Steam-Chef line contains the proper model, operated by direct steam, gas or electricity, to fit your exact cafeteria requirements. For steaming at its best, be sure your **equipment** is the **best**—which means Steam-Chef.

Send for interesting booklet "Getting the Most from Steam Cooking"



MODEL 101-3B
Cleveland "Steam-Chef"
Direct Connected Unit

Body Construction — One-piece welded bodies of heavy plate steel, rust-proofed or stainless, easy to keep clean and sanitary, insuring low maintenance cost and extra durability.
"Full Floating" Doors—An exclusive Steam-Chef feature, always seat perfectly, never require adjustments, prolong gasket life.
Safe Operation — Maximum safety results from doors which cannot be opened while steam is being admitted to compartment.
Synchronized Thermostatic Control—Achieves new economy and convenience. Eliminates necessity for steam vent line and cuts steam consumption 50% to 80%.
Automatic Control—of both fuel and boiler water level is provided on gas and electric units—an exclusive feature, effecting fuel saving of 33⅓%.
Sizes and Types—Over 50 models, sizes and types—capacities 2 to 7½ bushels per charge—standard units to fit practically any requirement.

Cleveland STEAM-CHEF
for better cooking -- STEAM

MODEL 2-SB
Full automatic gas operated "Steam-Chef." Gas and water automatically controlled

PROMINENT SCHOOL INSTALLATIONS

Dartmouth College, Hanover, New Hampshire
Cornell University, Ithaca, New York
Syracuse University, Syracuse, New York
University of Texas, Austin, Texas
Purdue University, Lafayette, Indiana
Vassar College, Poughkeepsie, New York
Ohio State University, Columbus, Ohio
Northwestern University, Chicago, Illinois
University of Wisconsin, Madison, Wis.
University Dining Halls, Princeton, New Jersey
University of Michigan, Ann Arbor, Michigan
A. & M. College of Texas, College Station, Texas
University of New Mexico, Albuquerque, New Mexico
Hunter College, New York, N. Y.
Duke University, Durham, North Carolina
University of Indiana, Bloomington, Indiana
University of Minnesota, Minneapolis, Minnesota
Michigan State College, East Lansing, Mich.
Mellon Jr. High School, Mt. Lebanon, Pennsylvania
Preston School of Industry, Ione, California
Cranwell Preparatory School, Lenox, Massachusetts
Madison College, Harrisonburg, Virginia
Kearney State Teachers College, Kearney, Nebraska
Louisiana Polytechnic Institute, Ruston, Louisiana
University of Akron, Akron, Ohio
Bellingham High School, Bellingham, Washington
Bryn Mawr College, Bryn Mawr, Pennsylvania
Mark Keppel High School, Alhambra, California
Everett High School, Everett, Washington
Brooklyn H. S. for Homemaking, Brooklyn, New York
Kalamazoo College, Kalamazoo, Michigan
Garfield High School, Los Angeles, California
Senior High School, Billings, Montana
Arthur Hill School, Saginaw, Michigan
Salem High School, Salem, Washington
Port Richmond High School, Richmond Borough, New York
University of Maine, Orono, Maine
Chicago Board of Education, various locations
Brooks School, North Andover, Massachusetts
Swarthmore College, Swarthmore, Pennsylvania

[Complete information and detailed specifications will be furnished on request. Sold through recognized kitchen equipment dealers everywhere.]

EDISON GENERAL ELECTRIC APPLIANCE COMPANY, INC.

5633 West Taylor Street, Chicago, Illinois

Hotpoint EDISON

Commercial Electric Cooking Equipment

Boston : New York City : Atlanta : Cleveland : Chicago : Kansas City : Dallas : Los Angeles : Seattle : Salt Lake City
CANADA — Canadian General Electric Company, Ltd., Toronto

Uniformly good cooking is assured in this modern kitchen because it is equipped with clean, dependable Hotpoint-Edison Electric Equipment. Installed before the war, this all-electric kitchen will be modern after the peace.

SEND FOR THIS BOOK

Every Hotpoint-Edison user should study the valuable information in our new book "How to Make the Most of Your Hotpoint-Edison Electric Kitchen." It contains many suggestions for saving fuel and prolonging the life of this valuable equipment.

How to Plan a Modern Post-War Kitchen

The Kitchen of the Future will be All-Electric

MAYBE you are not thinking of a new kitchen because we have a war to win before kitchen equipment again will be available for civilian use.

There are, however, no priorities on planning. You can study the trends in modern kitchens, familiarize yourself with efficient layout of equipment, and be prepared for the day when you can make the installation.

Hotpoint-Edison kitchen specialists will help you plan your modern post-war kitchen. They will give you facts and figures to prove that Hotpoint-Edison Electric cooking and baking will simplify food preparation, assure nutritious meals, guard against food waste, and cut your food cost.

In hundreds of schools, hospitals and other institutions Hotpoint-Edison Electric kitchens are setting new standards for good food prepared at low cost.

Let our kitchen specialists show you how the modern kitchen of the post-war period will be planned. They will explain why the kitchen of the future will be all-electric. Edison General Electric Appliance Co., Inc., 5633 West Taylor St., Chicago, Ill.

THE HOBART MANUFACTURING CO.

Makers of Electric Food-preparing and Dishwashing Machines for Commercial and Institutional Kitchens and Bakeries

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ATLANTA, 336 Marietta St., N.W.
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HOBART FOOD MACHINES ARE SOLD THROUGH LEADING KITCHEN OUTFITTERS

Under current restrictions only schools feeding Army and Navy Personnel are eligible to purchase kitchen machines. If you are doubtful about your status write us and we will advise you regarding your possibilities of obtaining Hobart Kitchen Machines.

GUARANTEE AND SERVICE

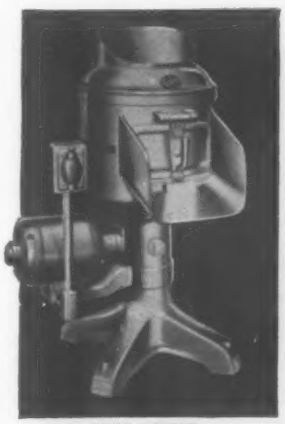
All Hobart Machines are fully guaranteed and serviced by *one* nation-wide organization. This avoids uncertainty, confusion, and money-losing delays — and greatly simplifies the purchase and maintenance of all machines used in your kitchen.

Illustrations show representative models only. Each line of Hobart Machines includes a range of sizes to fit any application, from the smallest to the largest school kitchen. Full information on all Hobart Kitchen Machines is always available.

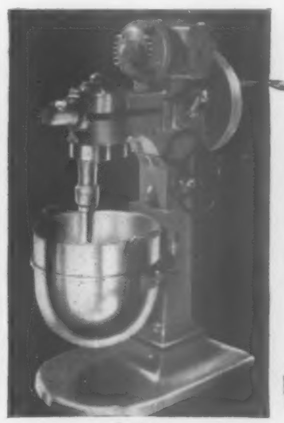
★ ★ ★

T-215-GAP FOOD CUTTER
Floor Type 15-Inch Bowl

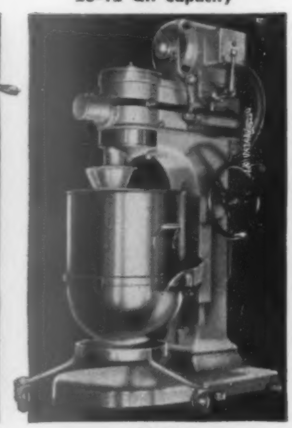
A-200 MIXER
Bench Type
20-12 Qt. Capacity



6025 PEELER
Floor Type—25 lb. Capacity



S-601
Floor Type—60 Qt. Capacity



M-80
Floor Type—80 Qt. Capacity

Model CM DISHWASHER

Model GM DISHWASHER

Model AM-4 DISHWASHER

WORLD'S LARGEST MANUFACTURERS OF DISHWASHERS, MIXERS, PEELERS, FOOD CUTTERS, SLICERS, CHOPPERS, COFFEE MILLS, SCALES

MARKET FORGE COMPANY

Everett Station

Boston, Massachusetts

Complete Control of Food Preparation with "MAFORCO" COMPARTMENT STEAMERS

Direct-Connected Thermostatically Controlled Steamer— *Model 3M*

Proved Advantages of Steam Cooking

Although proper preparation of food has taken tremendous strides during the last few years, the great majority of people do not yet realize the importance of **steam cooking** in **preserving vital food values.** Calcium, magnesium, phosphorus and iron, Vitamins B and C—all are soluble in water and are therefore readily lost by boiling. Live steam keeps the natural juices sealed within the food. Accepted research has shown that losses through steaming are only one-third of those incurred by boiling.

Flavor also is lost when soluble materials have been **cooked** or **boiled** out of foods. **Steam cooking** retains the natural, characteristic flavors of foods, as well as their proper **texture** and **color.**

Economy: Steam cooking is **less expensive** than previously used methods:—Less fuel is used. Food shrinkage is almost entirely eliminated. Kitchen space is conserved (one three-compartment steamer doing the work of a six-foot range in one-third the space); and, most important of all, there is a definite saving of operating labor. No attention is required during the steam cooking—no danger of boiling over, etc.—It is only necessary to time the brief cooking periods, and these cooking periods are almost unbelievably brief!

An interesting list of recent MAFORCO installations

Yale University, New Haven, Conn.
Cornell University, Ithaca, N. Y.
Harvard University, Cambridge, Mass.
Navy Yard, Bldg. 18, Portsmouth, N. H.
Boston Navy Yard, Charlestown, Mass.
Naval Base, Coco Solo, Canal Zone
S. S. Queen Mary
Fort Shafter, Hawaii
Northfield Seminary, E. Northfield, Mass.
Mystic Oral School, Mystic, Conn.
Classical High School, Springfield, Mass.
Edgewood Arsenal, Edgewood, Md.
Borinquen Field, Puerto Rico

Proved Advantages of the MAFORCO Low-Pressure Steamer

The MAFORCO modern line of Low-Pressure Steamers is now to be found in school and college buildings, hospitals and other institutions in all parts of the country because of its proved **efficiency, economy, speed, ease of handling, safety,** and the **first-rate, attractive, flavorful, nutritive** food which each steamer dependably turns out. Vegetables, meats, fowl, sea foods, fruits, puddings, all are quickly and appetizingly cooked in a MAFORCO compartment steamer. The use of separated compartments completely eliminates the intermingling of odors.

Operators find the MAFORCO compartment steam cooker also **easy to clean,** and **economical in both floor space and steam consumption.**

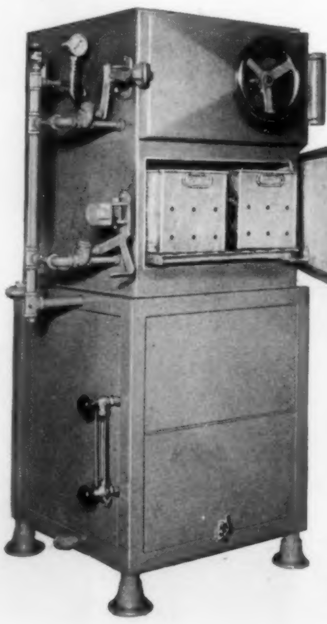
Only the **best of rust- and corrosion-resisting materials** are used in building the MAFORCO Steamer.

Special features are the ingeniously designed **full floating door** and the **automatic sliding shelves,** which pull out automatically when the doors are opened, making the hot steaming baskets conveniently accessible. **An important safety feature**—steam is automatically cut off before door can be opened.

The DIRECT-CONNECTED STEAMER is furnished either as a standard thermostatically controlled model which cooks at a steady, even temperature and conserves steam; or as a free-venting model with or without a condenser to carry the steam away.

The STEAM-GENERATING STEAMER operates on gas, steam, or electricity in establishments not provided with steam for direct-steam cooking.

For complete details on both these types, see the **booklet "Compartment Steamers for Modern Steam Cooking," sent free on request.**



Gas-Operated Steamer — Automatically Controlled —*Model 2M*

STANDARD GAS EQUIPMENT CORPORATION

Jersey City, N. J. Baltimore, Md.

BRANCH OFFICES: New York Boston Aurora, Ill. Chicago New Orleans Los Angeles

VULCAN GAS COOKING EQUIPMENT

How You Can Save Gas, Food, and Repairs for the Duration

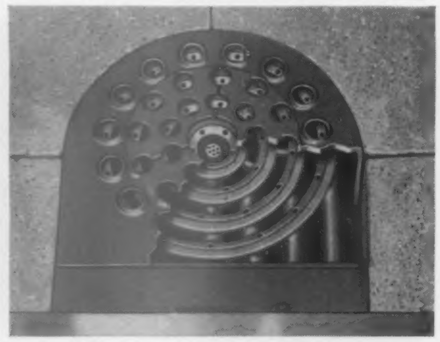
COVER TOP WITH POTS WHEN COOKING

Vulcan center-fire top puts every heat unit to work. A remarkably large amount of cooking can be done with only two of the four-burner rings in operation.

USE OVENS TO FULL CAPACITY

Roast two pans where one was cooked before. Vulcan two-compartment oven permits loading both bottom and rack without intermingling of food flavors or excessive side browning.

KEEP BURNERS CLEAN AND PROPERLY ADJUSTED



Dirty burners waste gas. Burners should burn with clean blue flames. Don't allow flames to lick up sides of vessels. Don't light gas before needed. Turn out immediately when cooking is finished.

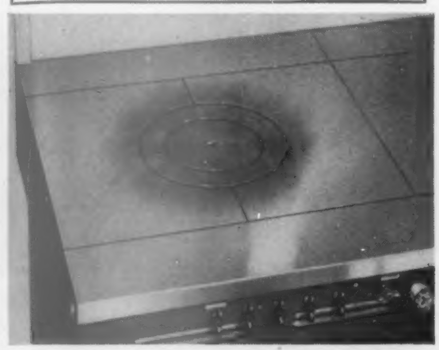
USE ONE RANGE TO FULL CAPACITY INSTEAD OF TWO TO HALF-CAPACITY

This will effectively reduce fuel consumption. Vulcan center-fire construction brings every vessel in hot zone. Radial fins carry heat out to edges making entire top effective cooking area.

ROAST AT LOW TEMPERATURES AND SAVE MEAT

You can get additional servings from every roast by using the low temperature roasting method. Vulcan's accurate oven heat control gives correct temperature by merely setting the dial.

DON'T BURN OUT TOP BY CARELESS USE



Don't light burners before needed. Vulcan center-fire tops heat quickly and can be kept hot with only the center rings lighted. ALWAYS turn out all rings not needed for the cooking job.

VULCAN PAYS FOR ITSELF IN SAVINGS

The Vulcan line includes ranges, broilers, ovens, deep fat fryers and miscellaneous equipment for main and diet kitchens. All units are designed to be hooked up in battery as shown here to form a most flexible installation with which you can equip or modernize your kitchen completely or in part, adding additional equipment as demands increase or budgets permit.

Complete Catalog HD 43 sent upon request.

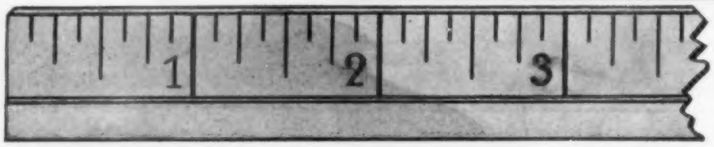
JOHN SEXTON & COMPANY

Manufacturing Wholesale Grocers

America's Largest Distributors of Number Ten Canned Foods

CHICAGO

Brooklyn Atlanta Dallas



CHICAGO

Use This Yardstick

FIRST differentiate between the Service to a retail grocery store, and the Service to a hotel, restaurant or institution. John Sexton & Co. sells no retail grocery stores, but offers the following advantages to all who feed many people each day.

SEXTON SERVICE	ANY OTHER SERVICE
1. Established in 1883—continuously under Sexton management. Responsibility—the highest.	1. ________
2. The largest inventory ever assembled for the particular needs of those who feed many people each day.	2. ________
3. Superb Service—Daily delivery New York and Chicago. All orders shipped within 24 hours of receipt.	3. ________
4. Coffee Merchants for 60 years. Direct importations—daily roasting. REAL HOTEL AND RESTAURANT BLENDS OF COFFEE.	4. ________
5. All fruits and vegetables selected according to Sexton specifications. Uniform number of servings to the tin.	5. ________
6. A complete variety of high quality preserves and jellies, gelatine desserts, extracts, mince meat, salad dressings made in Sexton Sunshine Kitchens.	6. ________
7. Sexton pickles, rich in Oriental spices, pickled in pure vinegar and crystal cane sugar in Sexton Sunshine Kitchens.	7. ________
8. Pre-eminent importers of Spanish olives—you save one profit.	8. ________
9. Tender leaf teas imported by Sexton from the foremost Tea Gardens of the Orient.	9. ________
10. A nation-wide staff of thoroughly trained salesmen, experienced with the needs of those who feed many people each day.	10. ________
11. Endorsed by the National Associations of the various enterprises feeding many people each day.	11. ________
12. The Sexton guarantee of complete satisfaction or money cheerfully refunded accompanies every sale.	12. ________

BROOKLYN

ATLANTA

DALLAS

SUPERIOR SLEEPRITE CORPORATION

Contract Department, 2219 South Halsted Street, Chicago

ANGLE IRON BUNK BED

Equipped with link-fabric springs. One of numerous space-savers (some of wood) for group sleeping quarters

MATTRESSES

Our modern mattress factory produces a complete line of mattresses and pads—all types of fillers, covers and construction—to any specifications permitted by regulations. Write for recommendations and quotations.

ARMY COT NO. CT 900

Angle iron ends and frame. Link-fabric spring

Cots, Folding Cots, Beds and Springs are available in numerous production designs. Adaptable to all space and comfort needs.

Volume Manufacturers of Bunkroom, Dormitory, Mess Hall and Hospital Furnishings — Made of Metal, Wood or Fabric and combinations thereof.

Schools participating in the War Training Program should avail themselves of the economy resulting from the experience of this Company as prime contractors to the several Government Departments—and the quick availability of hundreds of approved designs already in volume production.

WOOD BUNK BED

Convertible into twin beds. Complete with ladder and link-fabric springs. Other styles available or made in quantity to your specifications.

CHAIRS · DESKS · TABLES · CHESTS · BUREAUS · LOCKERS
WARDROBES · CABINETS · STOOLS · COUNTERS · BENCHES
***MESS TABLES* in both Standard and Custom Design**

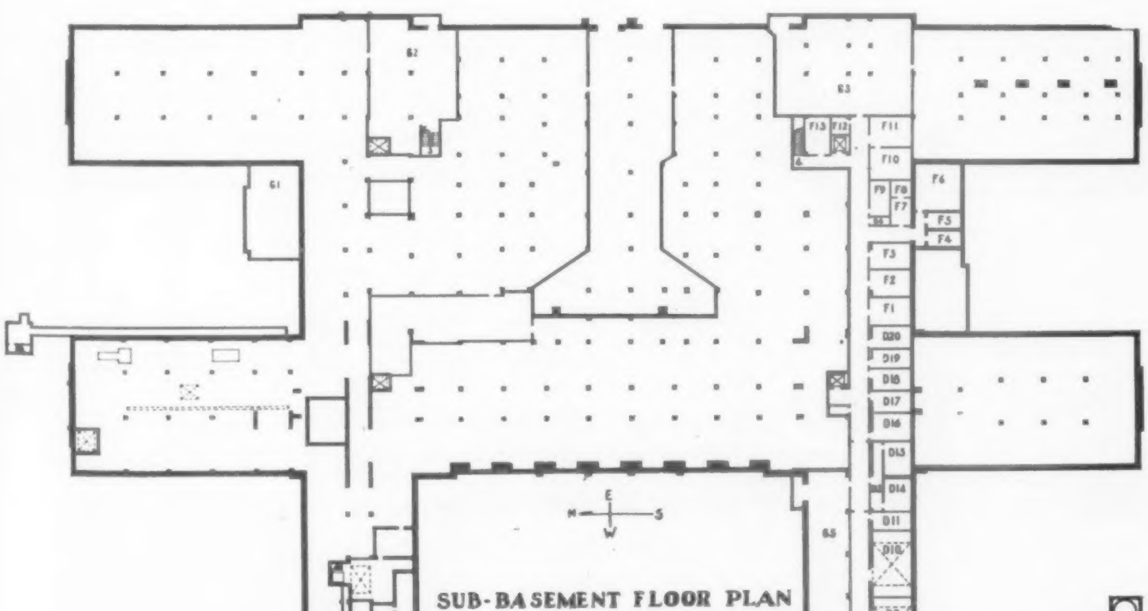
Write for Specifications and Prices

SECTION VIII
LABORATORY DESIGN AND EQUIPMENT

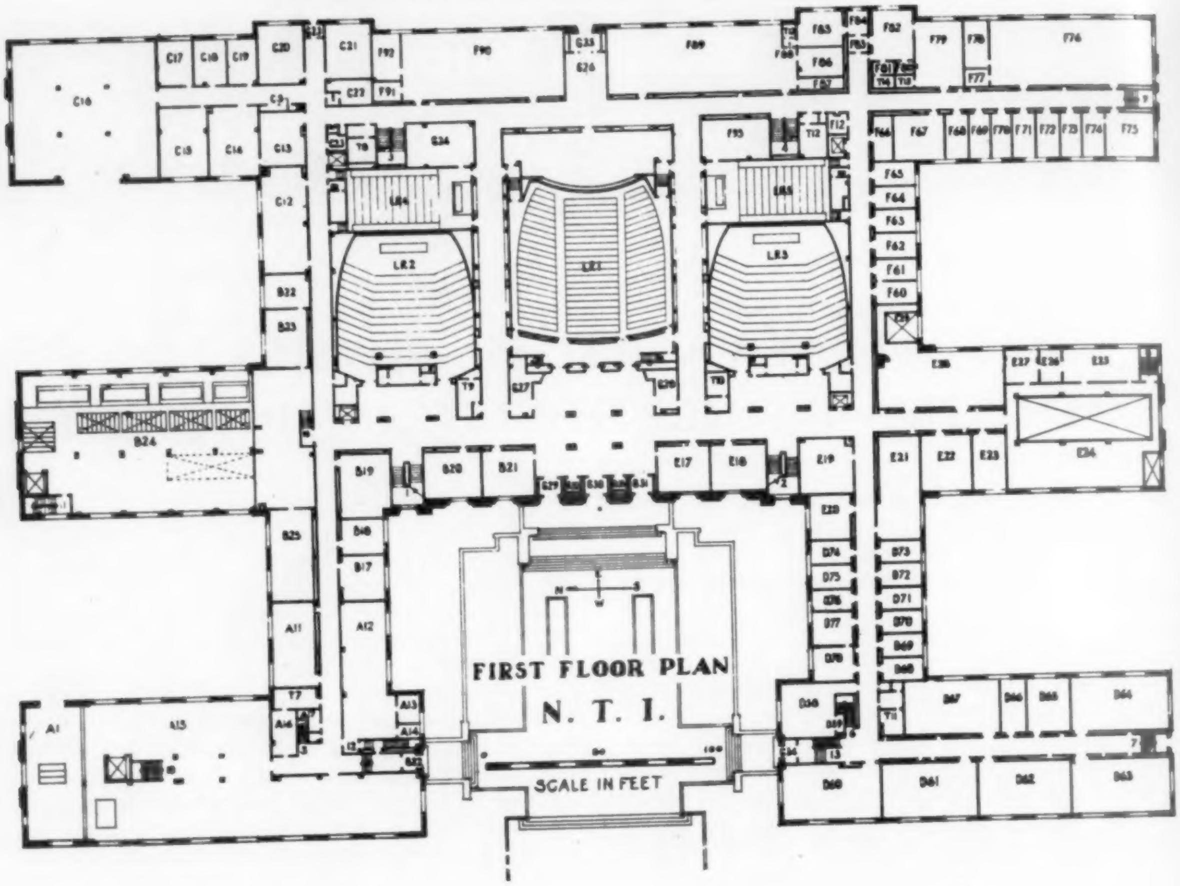
LABORATORY FACILITIES—PHYSICS AND CHEMISTRY—AT NORTHWESTERN UNIVERSITY

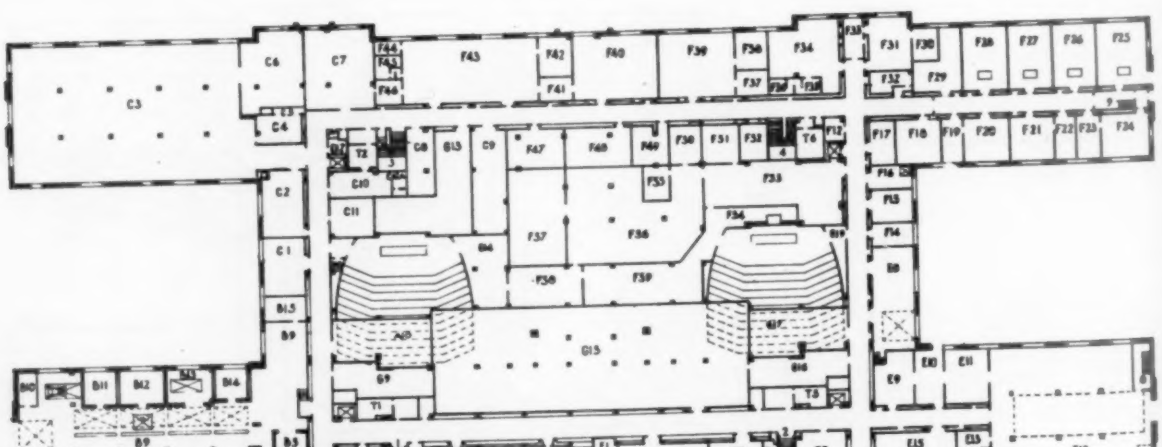
IN the spring of 1939, the Board of Trustees of Northwestern University announced the gift of Mr. Walter P. Murphy of Chicago for the development of a new technological institute, now known as the Northwestern Technological Institute. The kind of training to be offered by the institute is the cooperative type, in which the student after the freshman year spends one half of the remaining four years in industry. The choice of Northwestern University for its site was guided by the fact of its location near a large urban center with its multitude of industries, which enter into an effective type of engineering training. Another factor that influenced the choice was the existence of a well established College of Liberal Arts, from whose offerings the institute could freely draw.

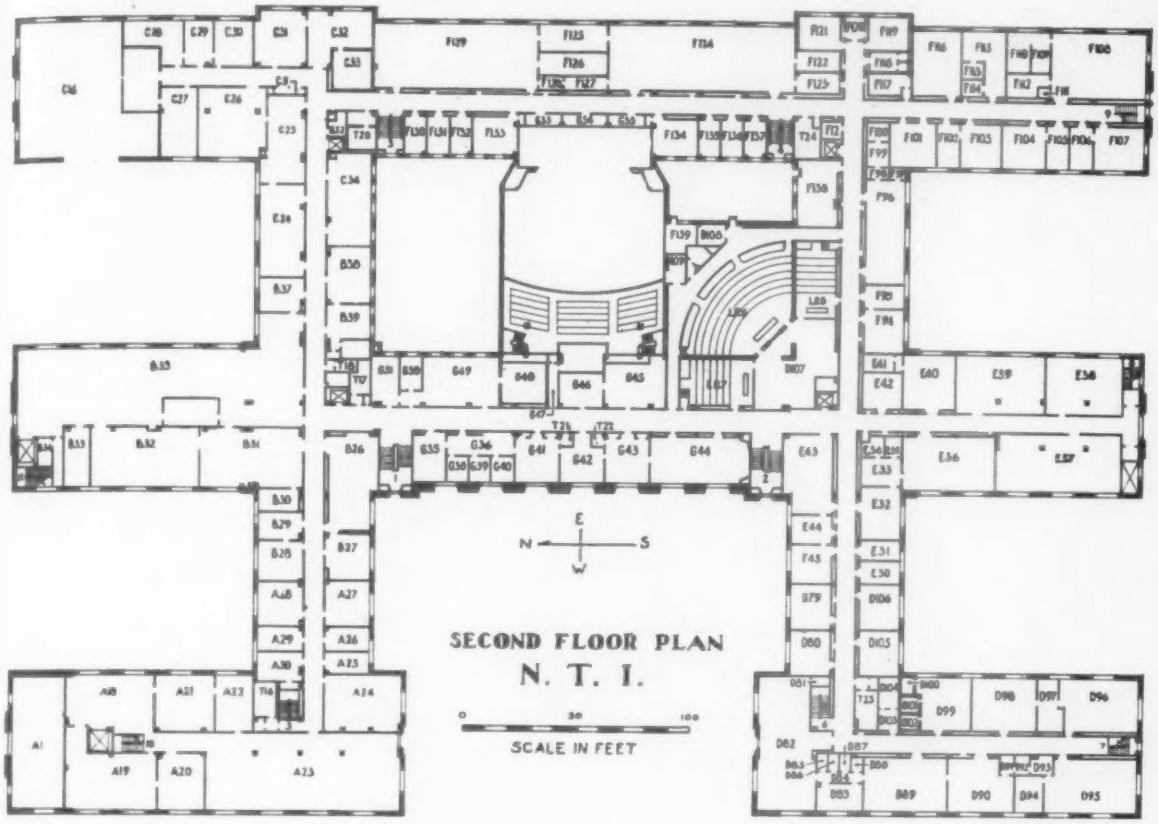
The gift of Mr. Murphy provided, among other things, approximately $5,000,000 for a new building and $1,000,000 for equipment. Mr. Murphy passed away December 16, 1942 and left an additional $20,000,000 to the institute. The building houses the departments of civil, chemical, electrical, and mechanical engineering, components of the Technological Institute; and the departments of physics and chemistry, which have always been components of the College of Liberal Arts. Still remaining as such, they can contribute to the curricular needs of the institute as well as if they were affiliated with it.



Physics department rooms are lettered "D"; chemistry department rooms, "F." See pages 270 and 274 for keys to the special rooms of these departments


FIRST FLOOR PLAN
N. T. I.
SCALE IN FEET


BASEMENT FLOOR PLAN
N. T. I.
SCALE IN FEET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SECOND FLOOR PLAN
N. T. I.
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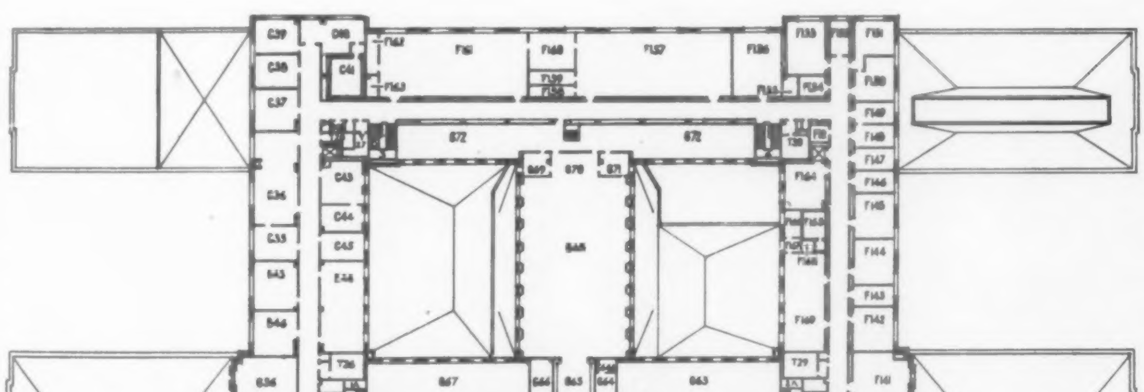
50
100
SCALE IN FEET


E
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THIRD FLOOR PLAN
N. T. I.
0
50
100
SCALE IN FEET

After the announcement of the gift, the architects, Holabird and Root of Chicago, submitted a general outline of the building. It involved roughly 450,000 sq. ft. of floor space and a volume of about 5,000,000 cu. ft. When the several departments were located and floor space allocated to them, department heads were requested to proceed with the design of their respective departments.

The New Physics Laboratory at Northwestern

By B. J. SPENCE

Chairman, Department of Physics, Northwestern University, Evanston, Ill.

The design and plan of such a highly specialized laboratory as a physical laboratory presents many aspects outside of the experience of the architect. Consequently the Department of Physics at Northwestern University had almost complete autonomy in disposition and plan of the 65,000 sq. ft. of its floor space, with excellent cooperation on the part of the architects and of the contractor, R. C. Wieboldt Co. of Chicago. Before proceeding with the plan and design of the building a few fundamental working principles were established. Staff members were assigned portions of the whole task for which they were best fitted, and the assignments were supervised throughout the construction. The plan worked excellently, and with complete cooperation on the part of the staff.

The Department of Physics uses the rooms designated "D" on the accompanying floor plans (see pp. 267, 268, 269). Special rooms are:

D14, D15 Soundproofed rooms
D9, D10 High potential laboratories
D1, D2, D5, D8 Spectroscopic research
D54, D55, D57 X-ray research
D21 Industrial spectroscopy
D32–D40 Physics shops
D41 Air and hydrogen liquefiers
D28, D31 Optics and spectroscopic laboratories
D61, D62, D63, D64, D65 Elementary laboratories
D82, D89 Electrical laboratories
D90, D95 Electronics laboratories
D96, D98 Heat laboratories
D118 Advanced graduate laboratory
LR 6, LR 7, LR 8 Physics lecture rooms

Plan and General Features

The outline of the building for the institute is seen from the floor plan. The Department of Physics occupies an L-shaped wing in the southwest portion of the structure and has approximately 120 rooms, including darkrooms and cubicles. The arm of the L running north and south has three floors, and that running east and west has five floors, including the sub-basement. The outer shell of the structure is of Lannon limestone trimmed with light Bedford limestone. It is designed to match the newer buildings on the campus, whose general style is that of a modified Gothic. The structure is of reinforced concrete and of fireproof construction throughout.

The unit of construction is 20 ft.; that is, beams forming bays are spaced 20 ft. apart. The columns supporting beams are built up from large-area concrete footings laid on clay. No piles are involved in the construction. The outer stonework is built around the concrete framework, and the partitions do not support any of the structure. This type of construction is important in that it gives a structural stability, as well as a flexibility in the way of changes in partitions. All partitions are in the main of terra-cotta hollow tile and finished with hard plasters.

The ceiling height is in general 12 ft. Corridors are generally 8 ft. wide with 10-ft. ceilings. The corridor walls are of a very light tan vitrified brick to a height of 7 ft., with a smooth plastered surface thereafter to the ceiling. The false ceilings in the corridors are of hard finished plaster with a 2-ft. space above for ventilation ducts, electrical conduits, and other necessary equipment. Corridor, office, and student laboratory floors are covered with a dark mottled composition tile. Steel window frames in the bays are 10 ft. wide and spaced 20 ft. apart between centers.

Considerations of efficiency and student traffic located the student laboratories and the lecture and recitation rooms on the main and second floors. The elementary laboratories, because of the large number of students in the elementary courses, are on the main floor. Offices are located in a group on the main floor in order to be easily accessible to the student and to enhance the esprit de corps of the staff. Special installations, such as the compressor for liquefaction for air and hydrogen, X-ray equipment, generator rooms, shops, and special research rooms, are on the ground floor. In the sub-basement are placed research rooms and installations requiring freedom from vibrations, such as sound-proofed rooms and spectroscopic grating mountings and equipment. Two two-story rooms for possible high potential research, with the floors in the sub-basement, are included in this group. The third-floor rooms are set aside for research. Research rooms, owing to the width of the bays, are approximately 10 or 20 ft. wide, and 19 or 23 ft. deep, depending on their location in the wings.

Lecture Rooms

The most effective design for a large lecture room presents a problem. It appears that the optimum seating capacity should be about 200. Demonstrations should be readily seen from all parts of the room. It should be well ventilated, temperature controlled, readily darkened, and provided with ample electrical power, gas, hot and cold water, steam, etc. An apparatus room should be adjacent.

The lecture rooms are located on the second floor

in the central section of the building. The large lecture room, with a seating capacity of 200, is fan-shaped with an angle of 90°. The lecture table is near the apex of the fan. The seats form quarter circles on graduated steps in colosseum style to provide effective observation of the lecture demonstrations. A recess above the lecture table makes possible effective indirect lighting and provides a space for moving supports on rails from which to suspend apparatus. Students enter the room at the rear from two neighboring corridors. Treatment of the rear wall and ceiling provide excellent acoustics. The lecture table is provided with gas, compressed air, steam, hot and cold water, adequate electrical service, and controls for an automatic projection lantern, sound projection equipment, a motor-driven screen, a projection voltmeter and an ammeter. The scales projected on a screen back of glass sliding blackboards are 4 ft. long. There are no windows in the room. The room is air conditioned and amply ventilated. Illumination is controlled by means of a dimmer.

On each side of the main lecture room are two smaller lecture rooms seating 40 and 50 students. They are provided with fully equipped lecture tables.

All three lecture rooms adjoin a lecture apparatus room equipped with cases with a storage capacity of 3,400 cu. ft. The equipment for this room consists of an electrical supply, gas, air, hot and cold water, a sink, work benches, and transport tables.

Elementary Laboratories

There are five elementary laboratories, practically identical in size and equipment, on the main floor. The rooms are 20 by 40 ft. and are arranged to handle a maximum of 20 students. An attempt is made to limit the size of the laboratory sections to 16 students. These laboratories are supplied with five islands equally spaced in a line through the middle of the room. These islands are provided with sinks, hot and cold water, air, gas, and an electrical panel with jacks connected to circuits to a distribution board in the room. At convenient stations on the walls are located small electrical panels with jacks connecting to circuits leading to the distribution board. The illumination in the room is controlled by light-proof shades. Fluorescent lamps in the ceiling give an illumination of approximately 25 foot candles on the tables.

Located in the suite of elementary laboratories is an apparatus room to care for the ten sets of equipment for each experiment. Adjoining this room is an office supplied with desks for the laboratory teaching assistants.

The Electrical Laboratories

The three electrical laboratories on the second floor, with an associated apparatus room, constitute a suite. The rooms are assigned for electrical measurements, advanced electrical measurements, and electronics. Adjoining the electrical measurement laboratory are small cubicles provided with electrical panels, a sink, hot and cold water, air, and gas for special experiments requiring insulation and a darkroom.

Spectroscopic and Optical Laboratories

The student spectroscopic and optical laboratories are on the ground floor. Adjoining these laboratories are a darkroom and an apparatus room provided with cases, work benches, etc., for minor repairs. Also adjoining the optical laboratory are four cubicles for experiments requiring no general illumination. Each cubicle has a port 3 ft. from the floor for systems where either source or observer may be in the cubicle. These laboratories are equipped with air, gas, hot and cold water, and electrical panels.

The laboratory set aside for industrial spectroscopy has associated with it a darkroom with special facilities for rapid photographic service. A 33,000-volt 15-kw. transformer serves as a source for the high potential spark required for this type of metallurgical analysis. The laboratory is so equipped and set up that complete analyses may be made in six minutes.

In the sub-basement is the suite of four rooms containing the spectroscopic gratings and equipment. One room, equipped with sources of power, etc., serves as a source room for two adjoining rooms carrying grating mountings. One of these rooms is provided with a concrete semicircular pier of 35-ft. diameter for mounting photographic plates and grating, and a pier located at the center of the semicircle on which to support the grating mounting. These piers are an integral part of a special floor designed to free the piers from mechanical vibrations and disturbances. This room will be provided with a 30,000-line-to-the-inch grating, 8 in. long, set up in a modified Paschen mounting. The second room is provided with piers on a special vibration-free floor for a Wadsworth mounting involving another 8-in. grating of 15,000 lines per inch. The third room in this assembly is set aside for interference spectroscopy, and is provided with a suitable vibration-free pier for the necessary equipment. Two darkrooms are associated with this suite.

The Hydrogen and Air Liquefiers

The room housing the compressors for air and hydrogen liquefaction has a floor independent of the building. Reinforced concrete walls are mounted on piers extending to the same depth as the building footings. A floor drain covered with a steel grating extends around three sides of the room. Two fans direct the ventilation of the room to the outside. Windows and all equipment in the room are explosion-proof.

The air compressor has a capacity of 5000 cu. ft. per hour and is operated by a 50-hp. motor. The hydrogen compressor has a capacity of 2000 cu. ft. per hour and is operated by a 25-hp. motor. The tank hydrogen is stored in a gasometer in a small building outside of the room.

The installation provides equipment for research and serves as a source of supply for other departments.

Cryogenic Laboratory

Adjoining a research room is a cold room whose temperature may be reduced to −40° C. It is insulated with 8 in. of cork blocks in two layers, sealed in hydrolene, with overlapping joints. The walls are finished with cement plaster, asphalt emulsion, and aluminum paint with an asphalt base. The floor is of concrete 3 in. thick set on 8 in. of cork. The entry to the main room is through a small anteroom lined with cork 4 in. thick. The room is equipped with cooling coils for drying the air before it enters the main room. The door to the entry room is a standard refrigerator

The large lecture room for the Department of Physics. Seats for 200 persons are arranged in quarter circles on graduated steps, so that demonstrations can be seen from all parts of the room

The explosion-proof room in the physics wing. The air compressor at the left has a capacity of 5,000 cu. ft. an hour, and the hydrogen compressor at the right has a 2,000 cu. ft. an hour capacity

Industrial X-ray apparatus of the physics department. The X-ray laboratories are designed primarily for research and metallurgical analysis

door and that to the main room is a super-seal refrigerator door.

This type of construction permits the main room to be operated for a period of probably eight months without defrosting. The entry room operates at a temperature between 0° C and −5° C. Thermostatic control will hold the temperature of the main room between −33° C and −36° C with the compressors operating less than 10% of the time.

Observations in the cold room may be made through a window consisting of four thicknesses of plate glass spaced ½ in. apart. The spaces between the glass are partially filled with calcium chloride to prevent frosting. The window is closed on the outside by a standard refrigerator door.

The X-Ray Laboratories

The X-ray laboratories make up a suite of five rooms, including a darkroom and a small anteroom with a lead glass window opening into the room containing the large X-ray plant. The rooms are equipped with a standard X-ray diffraction unit, a 200,000-volt machine, and a 60,000-volt unit with a rotary high potential rectifier.

The 200,000-volt industrial unit is housed in a room completely shielded with ⅜ in. of lead. The apparatus cannot be operated unless the lead-covered door is completely closed. The transformer and tube are mounted on a crane boom in such a manner that the tube may be operated at almost any azimuth.

Sound Laboratories

The sound laboratory for student use, located on the second floor, consists of one moderate-sized room with three small sound-proofed rooms at one end. The main room is supplied with electrical panels, air, gas, and hot and cold water. The small sound-proofed rooms are lined with 8 in. of rock wool throughout, and are equipped with standard sound-proofed doors. The walls between the rooms have openings 1 meter square for sound transmission measurements, etc. These openings may be closed by double sound-proofed doors.

The three sound-proofed rooms in the sub-basement required considerable thought. The larger room consists of a walled enclosure housing the room. This inner room, mounted on rubber, has a mass of 100,000 lbs., with a reinforced concrete floor and ceiling, and walls of a double layer of sound-absorbing tile. The tile is laid with no overlapping joints. The whole is as nearly monolithic as such type of construction would allow. After some experimentation it was decided to mount the room on rubber loaded to give the whole a period of about two seconds. Experiments showed conclusively that rubber properly loaded considerably excelled damped vibrating springs. There is no assurance, however, that the rubber will not deteriorate. In such an event concrete plugs in the floor may be lifted and the load removed from the rubber by hydraulic jacks, and a new material used. The inner and outer sides of the walls of the room were covered with a 1-in. layer of sprayoflake, a material consisting of flaked paper and a mastic. For further absorption, and also to prevent internal reflection, the ceiling and walls of the room were covered with 16 layers of spaced muslin and flannel. The entrance to the room from the control room is closed by double special sound-proofed doors. No electrical circuits enter the room and it has no ventilation, owing to the problem of sound insulation introduced when such features are present.

The smaller room is constructed in a similar manner, with the exception of the wall covering. The walls are covered with 4 in. of glass wool. In this room, as well as the larger room, the floor is covered with spaced layers of glass wool and covered with an iron grind. Conservative calculation indicates that the larger room will absorb 98% of air-borne sound and mechanical vibrations from the outside.

Electrical Supply

A physical laboratory is no more complete than the distribution of an adequate power supply. Three interconnecting switchboards were installed—one on the ground floor, supplying rooms in the sub-basement, ground floor, and main floor; another on the second floor, supplying rooms on that floor; and one on the third floor. The primary source of alternating current is the local power company. All panels in the boards are enameled steel. There is no exposed wiring. The main board, on the ground floor, carries controls for the supplies from four direct-current generators in a room adjacent to the switchboard. It also carries outlet jacks from 12 storage batteries of 10 volts each, having a capacity of 240 ampere hours, housed in an adjacent room. The necessary charging facilities are incorporated on the board. There are

also outlets for 120-208 volt A.C. supply, 208-volt A.C. three-phase supply, 120-volt regulated A.C. supply, 4-, 8-, and 12-volt A.C. supply, and a timer with the impulse intervals of .1, .5, 1, and 2 seconds. All transfers of supply to the various rooms are made through jacks on the board and plugs with attached cords. Male and female jacks are so arranged as to minimize danger from errors in making transfers. A color code incorporated in the jack caps differentiates the various kinds of currents. The transfer lines to the various rooms are designed to carry 50 amperes. Many of the rooms, particularly research rooms and electrical laboratories, are provided with lines adequate to handle 100 amperes. All wiring is carried in conduits, many of which are incorporated in the concrete structure.

The boards on the second and third floors are similar to the one on the ground floor with the exception of the D.C. generator controls. To the board on the second floor is connected another set of 12 10-volt storage batteries of large capacity, with adequate controls for charging. Each student laboratory is provided with its individual distribution board, which is fed from the A.C. lines and transfer circuits from the nearest main board. The local distribution boards, by means of jacks and plugging cords, feed the various panels in that laboratory. They are also of steel. Small panels are of bakelite, the circuits terminating in jacks. Most of the panels in the various laboratories and in the research rooms carry three transfer circuits to the main board, and a 120-208 volt A.C. supply of 50 ampere capacity. To obviate the necessity of plugging cords with a great variety of lengths, a binding-post plug was designed which has been found very satisfactory. Since the main boards are interconnected, it is possible to provide any room carrying outlet panels with any source of available power; and to interconnect through the switchboards any two rooms in the building. Complete flexibility is accordingly obtained.

The laboratory possesses a 6000-volt, 30-kw. D.C. motor generator set. The generator has 4 1500-volt units, the leads from which terminate on a special board which carries the field controls for the generators. Special circuits, leading to a number of rooms which may require such a potential, are fed into jacks on panels having a push-button control designed to open the generator field when for any reason it is desired to remove the potential from the panel.

The New Northwestern Chemical Laboratory

By MEMBERS OF THE CHEMISTRY DEPARTMENT *

THE magnificent new building which houses the engineering units of the Technological Institute also houses the departments of chemistry and physics of the College of Liberal Arts. The chemical laboratory includes the entire east front of the building, except the northeast wing, and the south side of the building between the southeast and south-center wings. This makes an off-center T-shaped unit, the top of the T being 340 ft. long and the upright portion of the T being 145 ft., except on the third floor, where it is 215 ft. long. The laboratory extends for five stories from the sub-basement to the third floor.

The Department of Chemistry uses the rooms designated "F" on the accompanying floor plans (see pp. 267, 268, 269). Special rooms are:

F1, 2, 3 Constant temperature
F10, 11 Battery and generator
F33, 56, 57, 58, 59 Storage and dispensing
F54 Preparation
F12 Distillation tower
F48, 49 Shops
F47 Special instruments
F43, 42, 41, 40 Physical chemistry
F39, 38, 37 High pressure catalysis
F34 Inorganic
F18 to F33 Offices and research laboratories in air conditioned wing for physical chemistry
F60-75 Offices and staff laboratories
F76, 89, 90 Elementary chemistry laboratories
F82, 84, 85 Departmental office
LR3, LR5 Main lecture rooms used by Chemistry Department
F96 Biochemistry
F108 Advanced quantitative analysis
F115 Microchemical analysis
F124, F129 Quantitative analysis and elementary physical
F130-F137 Research
F169 Qualitative organic
F141-153 Offices and research rooms for organic chemistry
F156 Advanced organic
F157, 161 Organic

General Facilities

Constant-temperature rooms and storeroom facilities are in the sub-basement. The physical chemistry laboratories and research rooms, as well as the general storeroom and many staff offices, are on the ground floor. Departmental offices, other staff offices, and the laboratories in general chemistry are on the first floor. Large laboratories for work in analysis and biochemistry are on the second floor, together with the microanalytical laboratory and many research laboratories in organic chemistry. The third floor is devoted entirely to organic chemistry.

The main chemistry lecture room, seating about 300 persons, is approached either from the basement or the first floor. A smaller lecture room with 108 seats is on the first floor. Both of these lecture rooms are adjoined by preparation rooms which open directly into them, so that lecture demonstrations may be prepared conveniently. Part of the lecture-room desk is portable, to facilitate transference of demonstration equipment. Both of these lecture rooms are equipped with projection booths.

The various laboratories of the building are equipped with wooden desks topped with alberene

* Of which Professor Ward V. Evans is Chairman.

stone. At the doorway of each laboratory is an emergency shower for use in case of fire or severe acid burns. Fire extinguishers are in the hall and in the student laboratories. Each laboratory is equipped with aluminum wall channels, placed vertically at 3-ft. intervals, and in the more open rooms of many of the research laboratories, ceiling slots are also an integral part of the building, such facilities making possible the suspension of apparatus or services from the walls or ceiling.

Windows 10 ft. wide, spaced 10 ft. apart, provide excellent daytime illumination. The windows are fitted with interior screens and venetian blinds. Fluorescent lighting is provided in each office and laboratory. Asphalt tile floors are used throughout.

Laboratories for General Chemistry

The facilities for 608 students in elementary chemistry are divided into three laboratories, so that the students may be conveniently sectioned according to interest and experience. This arrangement brings the student into constant contact with one instructor, with whom he becomes well acquainted.

A new simplified type of chainomatic balance, which permits the student to do exact quantitative work in the minimum time, was developed for use in these laboratories. Individual downdraft hoods and semimicro equipment including individual sets of reagents enable students to spend time doing experiments and learning chemistry rather than wandering about the laboratory. Quantities of equipment are sufficient so that not more than two students at the same time use even the more expensive articles, such as balances and centrifuges; thus no time is lost waiting for apparatus to be made available. The whole idea of the laboratory is to use the time of the students as efficiently as possible in the actual learning of chemistry. Readily accessible to the student is a conference room, with assistants in attendance to help the beginners.

Organic Laboratories

Following the course in general chemistry is the one in organic chemistry. Two large laboratories for this purpose on the third floor are capable of accommodating 225 students. Each student has 5 lin. ft. of desk space, and each two adjacent students have a sink between their desks, which is a matter of both convenience and safety. The inside walls of the rooms are generously provided with efficient hoods.

These laboratories have connecting balance rooms, coat rooms, and a service room. The student desks are equipped with air, steam, water, electricity, and gas. One feature of the desks, common to all student laboratories, is a long drawer capable of holding condensers and tubing. The design of the shelving also is such that both tall and short equipment may be stored readily in the desks.

An advanced organic laboratory capable of accommodating 18 students in two sections is also on the third floor. This room is designed for preparations to be worked either on the desk top or on the floor adjacent to the wall, which is well equipped with services. This laboratory also is supplied with a connecting balance room.

A room particularly designed for qualitative organic analysis is also on this floor. This room is capable of handling 32 persons in two sections. Leading from this laboratory is a coat room, a balance room, and a service room for the course.

On the second floor a room is set aside for organic combustion analysis. This room is equipped also with modern apparatus for Kjeldahl determinations.

Laboratories in Analytical Chemistry

Two large laboratories for instruction in quantitative analysis are on the second floor. Each student is generously provided with desk space. Large hoods with controlled top and bottom draft, and specially designed tiers of steam baths with drafts across the tops of the baths, are provided on the inside walls of these rooms. Separate balance rooms with chainomatic balances are provided for all undergraduate work. The balances are placed on small shelves, below which is a long, broad table so that students have ample space in which to lay their books and desiccators while weighing. In the combined elementary physical chemistry and quantitative analysis laboratory there is a special room for the storage of tall apparatus which may have been assembled by each individual student; there is also a room containing single pieces of apparatus which are too expensive to distribute to each student but which the students may use in turn, such as du Noüy tensiometers, glass electrode pH electrometers, and Wheatstone bridges.

The Physical Chemical Laboratories for Instruction

There is one large laboratory in the basement for elementary physical chemistry which will accommodate two sections of 30 students each, and a smaller laboratory for more advanced work. The advanced laboratory has the same equipment as the research laboratories of physical chemistry. In the elementary laboratory the student, besides having the usual desk space, has direct access to a fixed frame extending from a table 2 ft. high to a height of 7 ft. above the floor. These frames are equipped with all of the customary services and make for easy mounting of large apparatus. Beside the usual services provided in all of the chemistry laboratories, oxygen is piped to each desk. This is used both for glassblowing and as a standard in studying physical properties of gases. Water thermostat baths are provided for the study of properties at various constant temperatures. Adjoining the laboratory are balance rooms with analytical, heavy duty, and specific gravity balances. A darkroom permits photochemical studies with visible light, and a special electrical wiring system permits the distribution of electrical current of different voltages or frequency to each student desk.

Advanced Inorganic Chemistry.—The laboratory work in this course is conducted in a room in the basement designed to hold 24 students. In addition to the usual services and hoods, it is supplied with special hoods and canopies for large-scale or hazardous experiments. The laboratory has its own balance room and darkroom, the latter being designed for the preparation and study of photosensitive substances.

Biochemical Instruction.—The facilities in biochemistry are sufficient for all types of biochemical work. Most of the procedures carried out in the undergraduate laboratory are conducted on a quantitative basis. A large titration rack has been constructed in the middle of the laboratory, easily accessible for all students. All standard solutions are then siphoned

A laboratory for general chemistry. These laboratories are well-equipped, so that students do not lose time waiting for apparatus

A physical chemistry laboratory. The frames make for easy mounting of large apparatus. Oxygen piped to each desk is used for glassblowing and as a standard in studying physical properties of gases

The catalysis laboratory. Experiments are carried on with chemical reactions at pressures up to 6,000 lbs. per sq. in. and at temperatures up to 750° F.

directly into the burettes so that the students can carry out a maximum number of experiments in a minimum amount of time.

There is a completely air-conditioned animal room. The cages are specially designed for keeping many types of animals with a minimum of attention.

Research Facilities

Consideration of research needs was kept constantly in mind in planning the details of the new building. Several of the more important items are:

Organic and Biochemical Research.—The various rooms for investigation in organic chemistry on the second and third floors are designed to accommodate 60 to 70 research workers. All of these laboratories are built with slotted walls to assist in the construction either of shelving on the wall or of chemical equipment. Each room is equipped with water, distilled water, gas, air, steam, and A.C. and D.C. electricity. In addition to his laboratory desk, each research worker is provided with a study desk. Portable tables are accessible for any laboratory. Each laboratory is equipped with one or more hoods, and beneath most of the hoods is a steam-heated cabinet for drying apparatus.

For each 10 to 12 organic research workers there is provided an accessible room for apparatus used by this group. These rooms are a convenience in storing or constructing apparatus which would be injured by laboratory fumes or which would obstruct work on a laboratory desk. Such items as analytical balances, drying ovens, sodium presses, shakers, etc., are placed in these rooms.

Physical and Inorganic Chemistry Research Laboratories.—Five research laboratories, each in the basement wing in addition to four laboratories leading from professors' offices, are designed for research work in physical chemistry. These rooms are planned so that the permanent desks and services installed along the middle section of the room utilize effectively this part of each room. But there are no desks and drawers built along the walls, which gives to the laboratory a desirable flexibility in the construction of apparatus of unusual size and shape. The services for the apparatus built along the walls are hung on the aluminum wall channels, which have proved to be exceedingly useful, not only for this purpose, but also for the attachment to the wall of shelves, galvanometers, control boards, etc., at any desired height.

The services are tapped for extra outlets at foot intervals; they include gas, compressed air, water, and A.C. and special D.C. outlets. Steam and distilled water are available as well on the middle desk. Each special D.C. outlet can be separately connected to individual or series-connected batteries in the sub-basement battery room so that any D.C. voltage from 2 volts to 110 in units of 2 can be obtained. The use of the D.C. generators could increase this voltage to 500 volts. Each of the graduate student laboratories has one heavy-duty outlet which has a capacity of 70 amperes. Ceiling slots at convenient intervals make possible the support of apparatus and services by the ceiling. In four of the laboratories heavy concrete piers extend from floor level down into the ground independently of the building, so that apparatus can be built on these piers free from building vibrations.

The entire ground floor of the southeast wing is so arranged that it can be separated from the rest of the building, thus allowing the physical chemistry research laboratories to be air-conditioned in summer time. In this way electrical difficulties arising from high relative humidity can be avoided. Student writing desks and chairs in each laboratory; blackboards in laboratories and offices; hoods; adjustable stools; numerous stainless steel apparatus frames; emergency showers, and balance shelves with an underlying larger shelf, complete the description of these laboratories.

V. N. Ipatieff High Pressure and Catalytic Laboratory.—The experimental work in catalysis and organic chemical reactions at high pressure is provided for by a suite of rooms on the ground floor particularly designed for this type of experimentation. There is a separate bomb room and also a room for gas analysis. Chemical experiments may be carried out in rotating bombs up to very high pressures.

Microanalytical Laboratory.—A laboratory maintained at constant temperature and constant humidity for microanalytical work is located on the second floor. This consists of one large room partitioned off, with two rooms leading from it, one a darkroom and one a balance room. This room is designed primarily for research work and for instruction in microanalytical techniques.

Constant Temperature Rooms and Cold Rooms.—Three laboratories in the sub-basement, each 15 by 20 ft., are so designed that they can be maintained at constant temperatures. One is at 10° C., one at 20° C., and one at 37° C. There are two cold rooms for research purposes near the organic rooms on the second and third floors. These are equipped with labora-

Many intricate and unusual pieces of apparatus for the physics and chemistry departments are prepared in the well-equipped glass shop of the institute

tory services to carry out routine experiments near zero temperature. Each of these cold rooms, in addition, has an inner compartment which may be thermostatically controlled to temperatures as low as —20° C.

Distillation Shaft.—Provision was made in the construction of the building for construction of very tall equipment, such as distillation or extraction columns. A shaft 75 ft. high extends from the sub-basement to the top of the building, and at each floor level the walls of this 10-ft.-sq. shaft are generously provided with the usual laboratory services so that any anticipated experiments could be carried out therein. Removable floors are in place at each floor level.

Instrument Room.—This room, in the basement across from the physical chemistry laboratory, houses such special instruments and apparatus as precision balances, spectrographic equipment, a Jones conductance bridge, etc.

Shops.—The department has two adjoining shops in the basement, one for student use and one for the use of a skilled machinist.

Special Equipment

In connection with the new laboratories an extensive addition to permanent equipment was made, such items as these being ordered in quantity: vacuum pumps, thermostats, balances, electric ovens, variacs, stirrers, steam baths, hot plates, manometers, vacuum flasks, reducing valves, centrifuges, platinum ware, silica ware. In addition, several more expensive pieces of equipment were ordered, such as a quartz spectrograph, large Littrow model; chemical microscope, polarograph, ultramicroscope, spectrophotometer, Abbé refractometer, Hilger spectrometer, micromax set, hydrogenation apparatus.

Darkrooms

The chemistry laboratory is equipped with three darkrooms in addition to those in the microanalytical room, the inorganic laboratory, and the elementary physical chemistry laboratory.

Library

The library of the chemistry department is part of the library of the institute. Fifty-three chemical periodicals were taken by the library in 1942. In addition to a spacious reading room with a librarian in attendance, there are many carrels adjoining the stacks for the convenience of research workers.

Glassblowing

Much of the apparatus which is necessary in chemical research is made of glass. The chemistry department is fortunate in having the facilities of a well-equipped glass shop in the basement of the institute building. This shop is equipped thoroughly, not only with appropriate tools and lamps, but also with efficient annealing ovens.

Stockroom

The chemistry stockroom is in the basement and extends beneath the auditorium. In addition there are branch stockrooms on the second and third floors, connected to the main stockroom both by the elevator and by a dumbwaiter system. Each of the large student laboratories also has its stockroom, which is designed to serve the course in the adjacent laboratory. The main stockroom is equipped with an efficient glassware laundry, a metal enameling room, and various storage rooms. Separate rooms for dangerous chemicals and for storage of solvents are in the sub-basement. These rooms are equipped with an automatic carbon-dioxide system for fire protection.

Offices

Five rooms make up the departmental offices on the first floor. One of these rooms is the office of the departmental chairman; two others are general offices, and the fourth room is a duplicating room. With the offices is an attached conference room which serves for seminars, staff meetings, interviews, and the like.

Twenty staff offices are distributed on the four floors of the building. Most of these have attached laboratories for research work.

Small research laboratories like this adjoin many of the offices of faculty members

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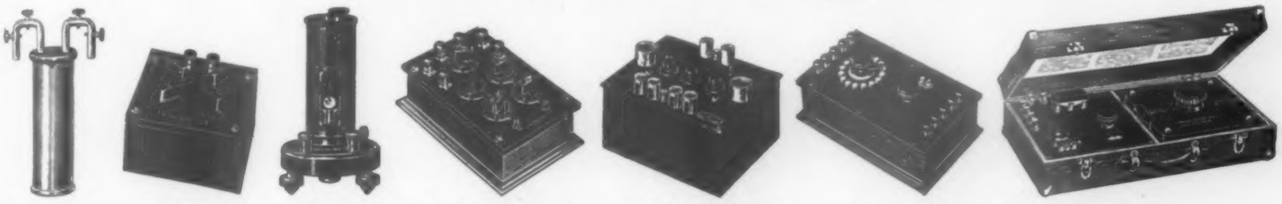

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Electrolytic Conductivity Measurements.......... Catalog EN-95
Sugar Ash Bridge................................ Catalog E-95-460(1)

Potentiometers. There is a choice of L&N potentiometers adapted to a variety of emf measurements; and of others specialized to measure emf as a function of temperature, pH or other specific quantity. Described in Catalog E, and in:

Thermionic Amplifier............................ Catalog E-00 A
Wenner Thermocouple Potentiometer............... Catalog E-33A(1)
White Potentiometers............................ Catalog E-33A(2)
Body and Skin Temperature Measurements.......... Catalog E-33-423
Apparatus for Checking Thermocouple Pyrometers.Catalog E-33A-503
Students' Potentiometer......................... Catalog E-50B(1)
Brooks Deflection Potentiometers................ Catalog E-50B(2)
Type K Potentiometers........................... Catalog E-50B(3)
Hydrogen-Ion Concentration (pH) Measurements..... Catalog EN-96
Portable Glass-Electrode pH Indicator .... Catalog E-96(2)
Portable Universal pH Indicator................. Catalog E-96(3)

Jrl Ad ENT-0441(1)

Photometers. Bar photometer, generally used for measurements of highest precision; visual and photoelectric sphere photometers, with which spherical candlepower of a lamp can be determined in a single measurement; distribution photometer, for determining polar light flux distribution around large lamps and luminaires; Macbeth Illuminometer, compact, portable, for measuring illumination . . . described in:

Photometers..................................... Catalog E-72

Miscellaneous Apparatus. Specialized measuring equipments facilitate certain routine tests: characteristics of magnetic materials; ratio and phase-angle of instrument transformers; specific inductive capacity and power factor of solid and liquid dielectric materials; insulation resistance; chemical analysis, using the dropping-mercury cathode method; and other tests. Described in Catalog E; further details in:

Silsbee Current Transformer Test Set.......... Bulletin E-50-501(1)
Potential Transformer Test Set................ Catalog E-50-501(2)
Insulation Resistance Test Set................ Catalog E-54(1)
Modified Schering Bridge for Specific Inductive
Capacity and Power Factor .... Catalog E-54(2)
Power Factor by Phase-Defect Compensation
Method .... Catalog E-54(3)
Bushing Test Set .... Catalog E-54(4)
Knorr-Albers Microphotometer .... Catalog E-90(1)
Electro Chemograph (Recording Equipment for Dropping Mercury Electrode Applications).......... Bulletin E-94(1)
Polarized Dropping Mercury Electrode........ Bibliography E-94(1)

Primary Elements, Accessories, Supplies. Thermocouples, resistance thermometers, pH electrodes, conductivity cells, accessories, supplies are listed in Catalog E. See also:

Thermocouples................................. Catalog N-33A(6)
Keys and Switches............................. Catalog EU2
Operating Supplies for L&N Equipments......... Catalog ENT-W

INDUSTRIAL-TYPE INSTRUMENTS AND FURNACES OFTEN USED IN LABORATORIES

Industrial-type instruments and furnaces have many laboratory uses. Micromax recorders reading directly in temperature, pH or other units furnish continuous chart records of test runs. Sometimes, recorders which control automatically, and non-recording controllers are used. Industrial-type indicators, portable models especially, are often used for a variety of measurements; optical pyrometers, for high temperatures. In metallurgical laboratories, Hump and Homo methods for hardening, carburizing, nitriding, tempering and annealing are applied through small electric heat-treating furnaces. Publications on request. Please be specific.

POWER-PLANT INSTRUMENTS

Instruments for the power plant are described in:

Combustion Control for Boiler Furnaces.......... Catalog N-01-163
Speed Recorders................................. Catalog N-27
Flowmeter (Centrimax) For Steam and Water ...... Catalog N-28-160
Temperature Instruments for Elec. Power Equip... Catalog N-33-161
Temperature Instruments for the Steam Plant..... Catalog N-33-163
Temperature Control for Superheated Steam... Catalog N-33-163(1)
Frequency Controller, Industrial Type......... Catalog N-56-161(1)
Load-Frequency Control for Interconnected
Power Systems .... Technical Publication N-56-161(1)
Frequency Recorders and Indicators.............. Catalog N-57-161
Load Telemetering and Totalizing Recorders...... Catalog N-58-161
CO_2 Recording Equipment for Flue-Gas Analysis.... Catalog N-91-163
Smoke Density Recorders......................... Catalog N-93-163
Condensate-Purity Instruments for Steam Plant.... Catalog N-95-163
Signalling Controller for Condensate Purity.... Catalog N-95-163(1)
Corrective Water Treatment.................... Bulletin N-96S-744A

WESTON ELECTRICAL INSTRUMENT CORP.

601 Frelinghuysen Avenue, Newark, N. J.

ENGINEERING AND SALES OFFICES

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WESTON INSTRUMENTS

Standard for Instruction, Research, Industry

The use of WESTON instruments in educational work and scientific laboratories has become a fixed principle, for nothing short of WESTON accuracy and dependability are acceptable for engineering training. WESTON instruments are made to most exacting standards of craftsmanship and accuracy. They inspire students to be exact in experiments. And in using WESTONS in training, the student is familiarizing himself with the instruments he will use throughout his engineering career, for student graduates since 1888 have "Westonized" the industrial world. . . . Following is a condensed listing of the WESTON instruments available; also are illustrated a few of the models widely used in educational work. Complete information on all models is available in booklet form, and will gladly be sent on request.

MODEL 622

Ultra-Sensitive Microammeters, Millivoltmeters

Double pivoted type instruments for measurement of minute currents. Ideal for laboratory work and circuits involving thermocouples, pyrometers, electron tubes, etc.

MODEL 525

Projection Instruments

Ideal for lecture and demonstration work. Scale can be projected to any desired size . . . seen from any room position. **Available in A-C and D-C scale . . . also with standard scales for all needs.**

MODEL 703

Direct-reading Illumination Meters

Available equipped with the stable, all-glass WESTON VISCOR filter which permits direct measurement of incandescent, mercury vapor, fluorescent and all other light sources, regardless of color composition.

PORTABLE AND PANEL INDICATING INSTRUMENTS
Ammeters, Voltmeters, Wattmeters, Galvanometers, Microammeters, Ohmmeters, Microfarad Meters

INSTRUMENT TRANSFORMERS
Portable and Switchboard—Potential and Current

RELAYS
Sensitive and Power Uses—Current and Voltage Types

ELECTRIC TACHOMETERS
A-C and D-C Types—Remote Indicating

LABORATORY STANDARDS
Voltmeters, Ammeters, Wattmeters

SPECIALIZED TESTING EQUIPMENT
Power Analyzer, Photoelectric Potentiometer, Battery Testing Instruments

SERVICE EQUIPMENT
Tube Checkers, Analyzers, Oscillators, Ohmmeters, Vacuum Tube Voltmeters

PHOTOELECTRIC CELLS AND CONTROL DEVICES
*Photronic Cells—Dry Disc Type

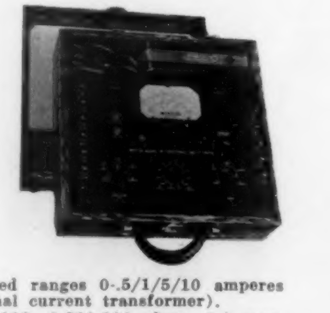
LIGHT MEASURING DEVICES
Illumination Meter, Foot Candle Meters, Sight Meter, Exposure Meters

TEMPERATURE INDICATING INSTRUMENTS
Electrical Type—Remote Indicating
Bimetallic Dial Type—Laboratory, Industrial

STANDARD CELLS

** Photronic—A registered trademark designating the photoelectric cells and photoelectric devices manufactured exclusively by the Weston Electrical Instrument Corporation.*

Industrial Circuit Tester — MODEL 785



A truly versatile instrument for shop or laboratory, with the following broad ranges:

D-C VOLTAGE . . . 0-1/10/50/200/500/1000 volts—20,000 ohms per volt. (*5000 volt range with external multiplier.)
A-C VOLTAGE . . . 0-5/15/30/150/300/750 volts—1000 ohms per volt.
D-C CURRENT . . . 0-50 microamperes, 1/10/100 milliamperes, 1 ampere and 10 amperes (*ranges above 10 amperes with external shunts).
A-C CURRENT . . . self-contained ranges 0-.5/1/5/10 amperes (*higher ranges with an external current transformer).
RESISTANCE . . . 0-3000, 0-30,000, 0-300,000 ohms, 0-3 megohms, 0 to 30 megohms (self-contained batteries). 0-900 megohms (*with compact Model 792 Resistance Tester).
* Extra equipment on special order.

MODEL 375

Student Galvanometer

Widely used in school laboratories where durability and low cost rather than extreme sensitivity are requirements. Other models of medium and high sensitivity available.

MODEL 430

Portable, Precision A-C and D-C Instruments

Universally used in schools and industry wherever rugged, portable instruments are required for general testing. Hand calibrated, mirror scales with knife-edged pointers.

Built-up Test Equipment

Available as volt-ohmmeters, volt-ohm-milliammeters and other combinations. The line also includes radio tube checkers, vacuum tube voltmeters, high frequency oscillators, etc.

HOW
GENERAL ELECTRIC
CAN HELP YOU

GENERAL ELECTRIC COMPANY

Schenectady, New York

GENERAL ELECTRIC offers its EDUCATIONAL SERVICES

GENERAL ELECTRIC

To Public School,
College, and University
Administrators and Supervisors

Gentlemen:

One of the most important factors in winning the war is the speed at which our schools are able to provide a dependable, continuous supply of young men and women who are technically trained so that they can take their places in war industries or armed forces, and fill those places efficiently.

During the war—and after the war—technical training is important. General Electric has always recognized this fact, and has long made it a policy to aid the faculties and students of our schools and colleges in every practical way.

Today, more than ever, we stand ready and willing to help you in this training of today's students for the work of tomorrow, and of the day after tomorrow.

Some ways in which we can do our part are to provide:

- Advisory service to educators
- Technical and descriptive publications
- Special educational services--including motion pictures and illustrated lectures.
- Proper laboratory equipment—for schools now, wherever they must expand to meet wartime needs; and for schools after the war, when men and women highly trained in the technical industries will be needed more than ever before.

Many publications, other than those mentioned, including instruction books and renewal-parts bulletins, covering G-E apparatus, are also available—and any General Electric office will gladly furnish authoritative advice on your laboratory problems involving the selection, application, or care of electric equipment.

Very truly yours

A C Stevens

A. C. Stevens
Educational Section

G-E Advisory Service

Many special problems of school shop and laboratory equipment and layout will be arising in connection with **current and future wartime demands** for men and women thoroughly trained in the technical industries. Competent G-E engineers stand ready to recommend laboratory equipment for the various types of courses required, and to help also in the preparation of shop and laboratory layouts.

To assist our engineers, we have retained the services of an experienced educator with a record of many years of successful teaching in vocational and technical schools; so G-E recommendations can be relied on to conform to the best educational practice, as well as to reflect the latest and best that science has to offer in the application of electric apparatus. There is no charge for this advisory service.

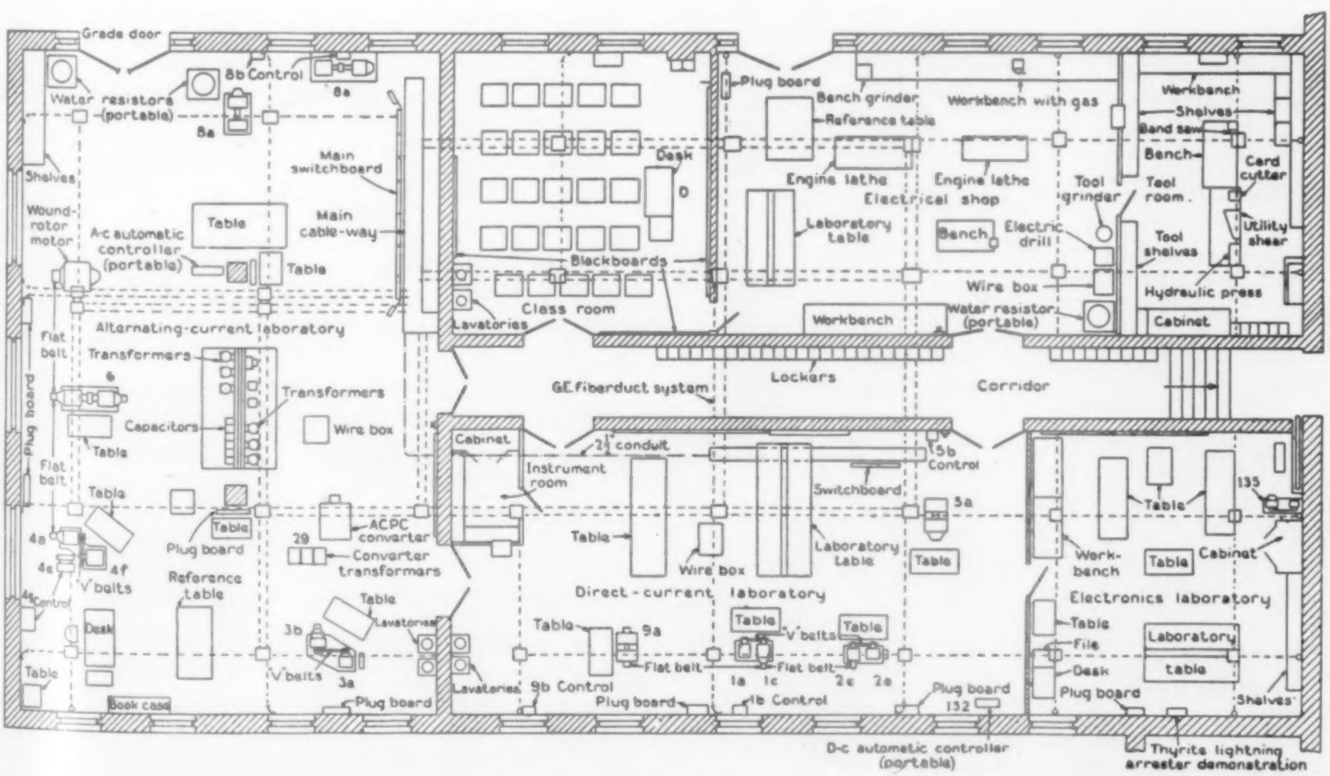
Many educators are already laying their plans for new buildings, or expansion of their facilities, to meet an anticipated need **after the war.** It is not too early to call in the services of G-E engineers now, to assist in those initial plans.

To save time and insure a layout or recommendations which will adequately meet local conditions, **we suggest that** the original request for G-E Advisory Service include answers to the following questions:

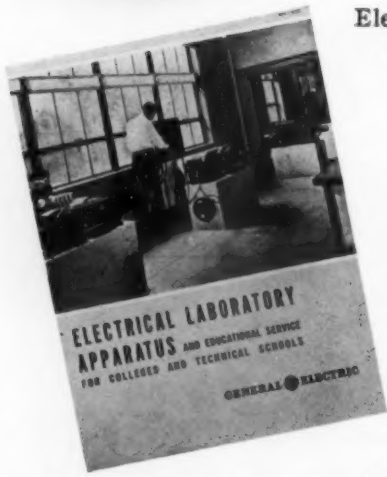
1. What types of technical, vocational, or industrial-arts courses will be offered?
2. To how many students in each case?
3. Day or evening classes, or both?
4. Length of each course in years, number of days per week, and hours per day?
5. New or old building?
6. What type of floors will be used?
7. Will classes be on the ground floor or above?
8. What power supply is available, and where is it located with reference to each room?

It is essential to include also a simple floor plan of the rooms available and indicate to scale, **sizes and locations of windows, doors, partitions, wash sinks, columns, etc.**

Below—a typical layout planned by General-Electric.



Partial List of G-E Technical and Descriptive Publications



Electrical Laboratory Apparatus GEA-1185

Bulletin GEA-1185 illustrates and describes G-E laboratory apparatus particularly adapted for laboratory use in vocational schools, high schools, and colleges. The General Electric Company usually recommends standard apparatus for laboratory instruction. It is recognized, however, that because of its size, cost, and the power required for operation, much commercial apparatus cannot be used in the laboratories of engineering schools and colleges. For this reason, this publication gives special attention to the selection for educational use of such standard apparatus as is of suitable size and will illustrate fundamental principles of design and construction as well as accepted commercial practice, supplemented, where standard apparatus is not suitable, with special apparatus designed for the school laboratory.

Electronics and Electron Tubes This publication gives, in easily understood language, the fundamentals underlying the so-called "vacuum tube" and includes simple experiments to illustrate these fundamentals. It includes numerous references, enabling students to read more extensively if they so desire. **Ask for Bulletin GET-568.** Single copies to teachers free; additional copies, 25 cents each.

Experimental Electronics —Laboratory Experiments on Electron-tube THEORY This series of laboratory experiments is designed to demonstrate the fundamental principles of electron-tube theory. Experiments are divided into two groups: those on high-vacuum tubes, and those on gas-filled tubes. **Write for Bulletin GET-566.** One copy per school free; additional copies, 15 cents each.

Experimental Electronics —Laboratory Experiments on Electron-tube APPLICATIONS This series of experiments on the application of electron tubes gives the student a clearer understanding of electron-tube characteristics under actual operating conditions. **Ask for Bulletin GET-620.** One copy free; extra copies 15 cents each.

Electronic Devices for Industry This is a small booklet outlining briefly typical uses of the various types of electronic tubes which the General Electric Company has made available to industry.

All publications listed on this page are free to schools and colleges (with the exceptions noted above).

Laboratory and Shop Equipment Specifications for Educational Institutions GEB-62

Bulletin GEB-62 lists in three different groups, equipment to meet a wide range of requirements.

For the elementary courses, a few of the more important types of machines are recommended, together with control apparatus, measuring instruments, and certain machine tools which should be in every electrical shop.

For more advanced work, or as funds become available, equipment from other groups may be added to provide well-balanced laboratory equipment permitting a wide range of experiments.

When deciding on the equipment for an electrical shop or laboratory, this bulletin will be particularly useful. In addition to listing the equipment, the booklet discusses briefly the several items, explaining why they have been selected and the use to which they may be put in the laboratory.

How to Select A-c Motors and Control, GED-847 — **How to Select D-c Motors and Control, GED-856**

In these twin booklets discussing a-c and d-c motors and control, you will find construction, design, and hook-up details on the selection of motors and control for specific jobs. Free copies are available. Also: Bulletin GEA-3531, entitled "How to Select Control for D-c Motors," containing the "How to Select" Chart; and Bulletin GEA-3488 on "How to Maintain D-c Motors."

Portable Instruments, A-c and D-c Bulletin GEA-1784 contains illustrations, descriptions, and specifications for high-accuracy, medium-size and pocket-size portable instruments, both a-c and d-c, plus complete scale-marking information.

SOME OTHER G-E BOOKLETS OF PARTICULAR INTEREST TO SCHOOLS

Little-known G-E Products for Industry—Bulletin GES-2136

The Science of Everyday Things—Bulletin GEB-109 (the principles underlying such household tasks as cooking, washing, and food preparation)

What's New in the World of Science—Bulletin GEB-107

"The Invisible World" and Other Stories—GES-2962 (fascinating adventures of scientists and engineers)

"House of Magic"—GED-872. **General Electric Motion Pictures**—GES-402. (See "Motion-picture Films," on page 285.) **"The Story of Lightning"**—GEB-124

Other G-E Educational Services

College Edition of "G-E Library Service"

Issued monthly during the school year and distributed free on an extensive mailing list. Contains references to selected articles in recent technical and commercial publications, brief digests of current G-E bulletins which are of special interest to educators, and other information of educational value.

Photo News Service

For many years General Electric has furnished some five thousand schools and colleges with semimonthly news posters telling briefly, authoritatively, and interestingly the story of the accomplishments of electricity and of the most recent developments in the Company's research laboratories. The posters have come to be almost standard equipment for many general-science teachers. They are published on the 1st and 15th of each month from October 1 through June 15. The service is free, to teachers only, at their school addresses.

Motion Picture Films

An extensive motion-picture service is maintained by the General Electric Company for the purpose of disseminating throughout the United States reliable information concerning important developments in the electrical field.

Silent pictures are furnished in 35-mm, safety or nitrate stock, and in 16-mm safety stock.

All sound pictures are available in 16-mm sound on film, safety base. Many are also available in 35-mm size. Films are lent free of charge with transportation charges paid by user.

These films are listed and described in General Electric's motion-picture catalog GES-402, copies of which may be had on application to the nearest G-E office. Requests for use of motion-picture films should be addressed as directed in that publication, and will receive the attention of a specialist.

Illustrated Lecture Service

Descriptive manuscripts, accompanied by suitable slide films, are available for general use, free of charge. A few lectures are available on glass lantern slides only, but the majority are available on 35-mm standard film.

All text and slide films are furnished without charge, and may be retained by the user, but all glass slides must be returned with transportation prepaid.

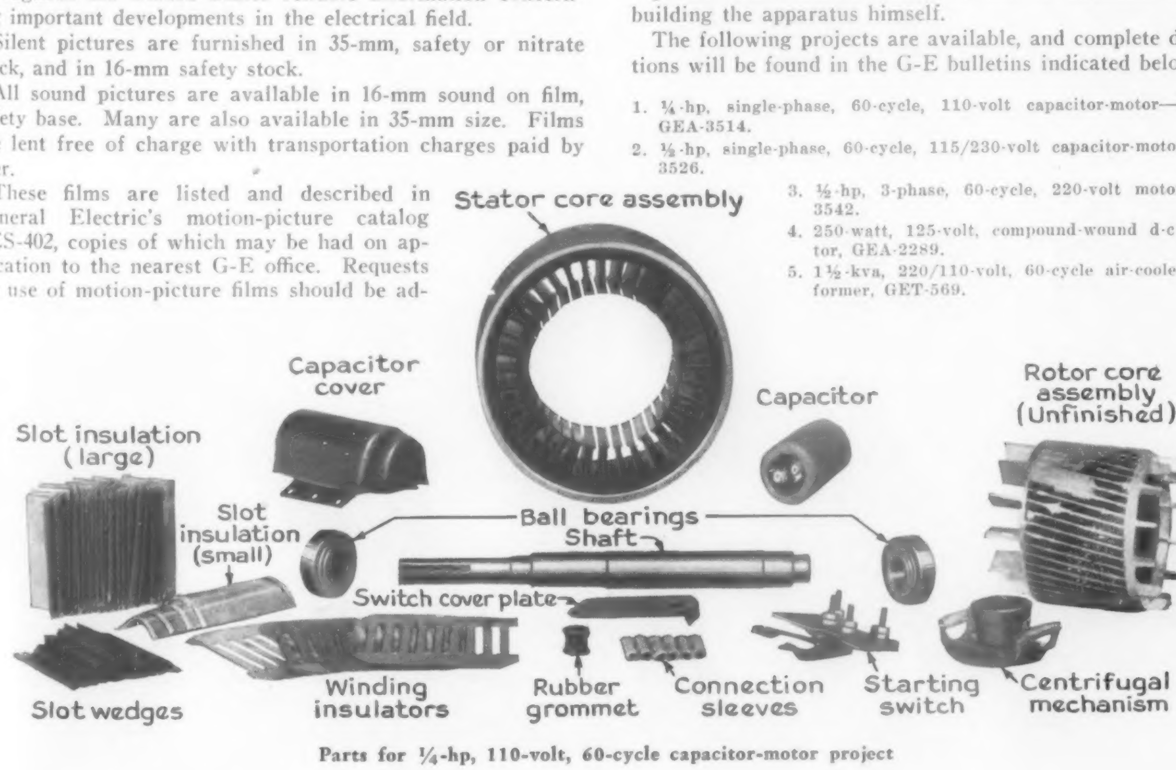
Educational Construction Projects

The General Electric Company, in carrying out its educational program, has sponsored the preparation and publication of several construction projects for technical and vocational schools. These projects are exceptionally valuable for the school shop since they are not merely assembly projects, but involve mechanical dexterity with such tools as the lathe, drill press, tap and die, etc.

G-E construction-project kits are deservedly popular throughout the country. The student gets a fundamental concept of actual construction that can be obtained only by building the apparatus himself.

The following projects are available, and complete descriptions will be found in the G-E bulletins indicated below:

1. ¼-hp, single-phase, 60-cycle, 110-volt capacitor-motor—Bulletin GEA-3514.
2. ½-hp, single-phase, 60-cycle, 115/230-volt capacitor-motor, GEA-3526.
3. ½-hp, 3-phase, 60-cycle, 220-volt motor, GEA-3542.
4. 250-watt, 125-volt, compound-wound d-c generator, GEA-2289.
5. 1½-kva, 220/110-volt, 60-cycle air-cooled transformer, GET-569.



Parts for ¼-hp, 110-volt, 60-cycle capacitor-motor project

G-E Laboratory and Shop Equipment

BINGHAMTON, NEW YORK

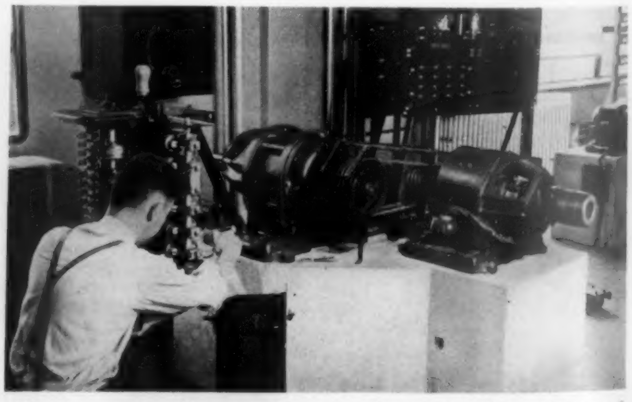
Working at the big educational switchboard, a student brings a motor-generator into synchronism. With this specially designed equipment, it's an easy matter to teach effectively the ins and outs of switchboard operation.

From New York to California, Users Are Enthusiastic about G-E Laboratory Equipment

In high schools, colleges, and trade and technical institutions the country over, G-E laboratory equipment is building an enviable record—a record for service, suitability, and long life. These typical installations may contain some helpful suggestions.

The local citizenry is proud of Binghamton's new North High School, with its modern facilities and equipment. The technical department boasts an excellent laboratory, complete with nearly all the laboratory apparatus illustrated here. Equipped exclusively with G-E apparatus, the laboratory, according to interested faculty members, has given great satisfaction since its construction.

The d-c section of the laboratory, equipped with convenient auxiliary boards and plug switches, making the power supply readily accessible. Note the concrete-block mountings; they serve the double purpose of providing a firm base and, at the same time, bringing the motor-generator sets up within easy reach of the student.



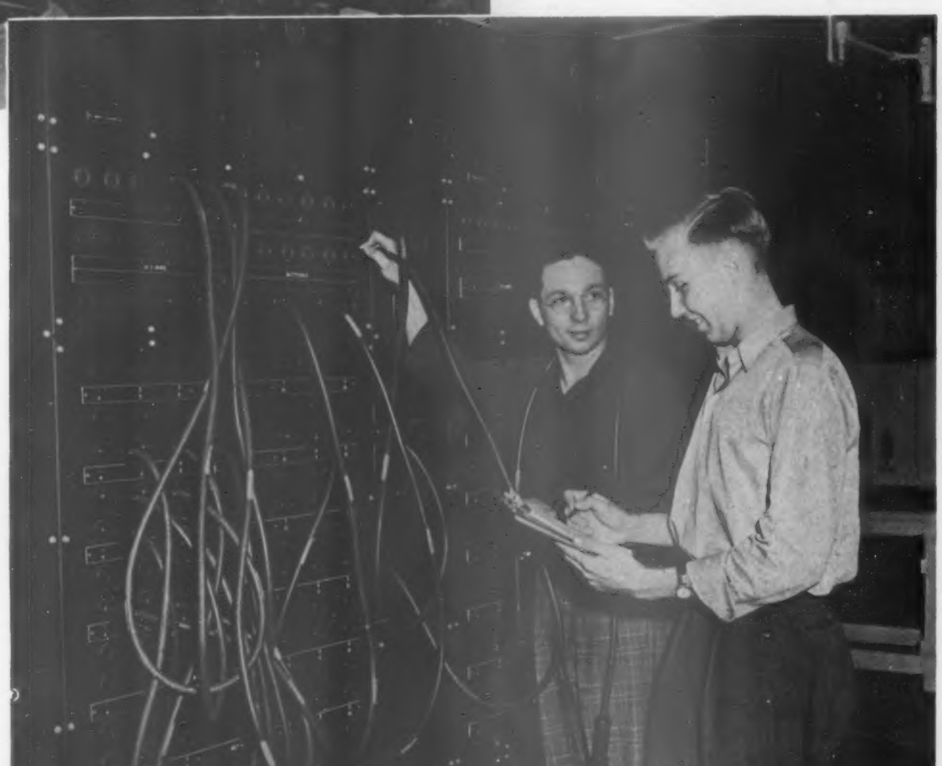
The drum controller provides a ready means of speed control on this belt-driven motor-generator set. Convenient terminals facilitate connections. An a-c control panel is shown in the background.

LOS ANGELES, CALIFORNIA

The University of Southern California has recently completed a new electrical laboratory. It is G-E equipped. The accompanying illustrations are representative of the facilities and equipment that make this laboratory outstanding.

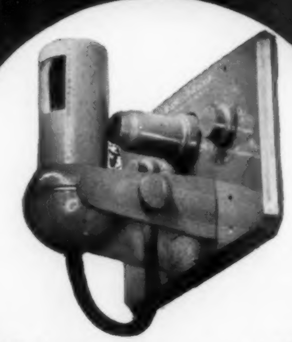
Here an a-c generator, direct-connected to a small turbine, is tested.

G-E panelboards and plug switches. Note the enclosed air circuit breakers shown at the top.



The G-E Type AH1 educational generator, showing the conveniently located terminal board and pulley for belt drive.

PLAN NOW TO REDUCE EYESTRAIN
with General Electric Automatic Light Control



Well-mounted room unit with light-sensitive photo-tube

Students' eyes protected by G-E automatic light control in typical school room

Eyestrain due to inadequate lighting can be prevented by two measures:

1. Provide enough lighting capacity to light even the darkest corner of the room.
2. Install G-E automatic light control to switch lights **on** whenever daylight is inadequate.

IN making your present building improvements and in planning your buildings after the war, do not overlook these precautions. There are thousands of General Electric automatic light controls now in use.

Maintains Light Level

G-E automatic light control by means of an "electric eye" keeps constant watch on daylight. It switches on the lights whenever daylight becomes too dim, owing to clouds, fog, smoke, or at sunset. In this way, adequate light is always provided. This scientific method of light control eliminates the inconvenience of switching lights on and off during classes in schoolrooms, and under other similar conditions, and compensates for human errors in judging light adequacy.

Economical

G-E light control also saves power, by turning off the lights when they are not needed.

Easy to Install and Adjust

G-E automatic light control is easy to install—any electrician can follow the simple instructions. Two small knobs, similar to radio controls, adjust the levels at which the lights go **on** and **off.** Your power company can check the light levels if you desire. The setting is permanent, but easily changed at any time.

"Sight is priceless—light is cheap." G-E automatic light control is low in cost, but its value in preserving eyesight is great.

Two models are available—one, to mount in wall, as shown in the illustration, usually used in new school buildings; the other, for surface mounting, usually used in existing buildings.

How Many Do You Need?

Where several rooms face in the same direction and have similar lighting conditions and equipment, one light control can be used for all rooms. Where lighting conditions and equipment differ, an automatic control unit is required for each room.

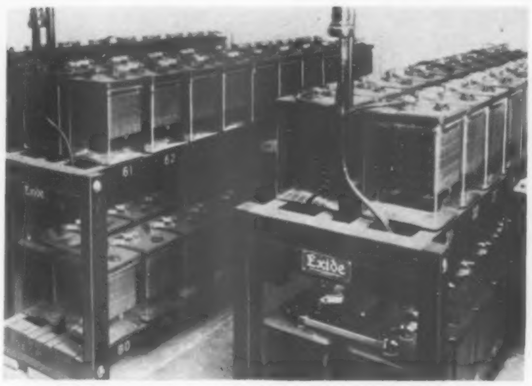
The nearest G-E office will gladly give you additional information on automatic light control, as well as complete details on G-E floodlighting equipment for school athletic fields, swimming pools, buildings, etc.—or write direct to General Electric, Schenectady, N. Y.

THE ELECTRIC STORAGE BATTERY COMPANY

World's Largest Manufacturers of Storage Batteries for Every Purpose

Allegheny Avenue and Nineteenth Street, Philadelphia, Pa.

Atlanta, Ga., 210 Walker St., S. W.
Boston, Mass., 100 Ashford St.
Chicago, Ill., 4613 So. Western Blvd.
Cincinnati, Ohio, 718-19 Temple Bar Bldg.
Cleveland, Ohio, 6400 Hermann Ave., N. W.
Dallas, Texas, 1118 Jackson St.
Denver, Colo., 810 14th St.
Detroit, Mich., 8051 W. Chicago Blvd.
Kansas City, Mo., 129 Belmont Blvd.
Los Angeles, 1043 S. Grand Ave.
Minneapolis, Minn., 617 Washington Ave., N.
New Orleans, 428 Balter Bldg.
New York, N. Y., 23-31 W. 43rd St.
Philadelphia, Allegheny Ave., and 19th St.
Pittsburgh, Pa., Union Trust Bldg.
St. Louis, Mo., 1218 Olive St.
San Francisco, Cal., 6150 Third St.
Seattle, Wash., 1919 Smith Tower Bldg.
Washington, D. C., 1819 L St., N. W.
In Canada, Exide Batteries of Canada, Ltd., 153 Dufferin St., Toronto, Ont.



The Exide Chloride Battery in The Research Laboratory of Physics, Harvard University. It is used for general service

FOR LABORATORIES, FIRE ALARM, PROGRAM CLOCKS, AUTO-CALL AND INTERIOR TELEPHONES

Exide Batteries are extensively used in the laboratories of the nation's foremost scientists, industrial research engineers, schools and colleges. Their performance records are the best testimony that can be offered as to their merit for laboratory services.

The foremost characteristics of Exide Batteries are absolute dependability and sustained high voltage until end of discharge. The operation of Exide Batteries is flexible. Cell connections to the battery can be arranged so as to give any desired voltage, with a wide range in discharge rates available at that voltage. By assigning a group of cells of the battery to a definite experiment, a constant voltage is assured which is free from disturbance or interference by any outside influence.

Exide Batteries of the sealed glass jar type have been carefully designed and are carefully constructed for laboratory service. They assure exceptional long life in laboratory service. Many Exide Chloride Batteries in laboratory and industrial installations have been in constant use for 20 or more years.

Regardless of how limited your budget appropriation, an Exide Battery can be selected to meet your requirements. Moreover, the wide experience of Exide engineers and the services of our nation-wide Exide organization are at your disposal. Write to the nearest Exide office shown above for further information.

PROTECTION AGAINST DANGERS OF SUDDEN LIGHTING FAILURE

Either children or adults, you can never predict the actions of a crowd that is suddenly plunged into darkness. Danger is real. Danger of personal injury . . . danger to school property.

The utility companies take every precaution, but cannot control the effects of storms, floods, fires, and street accidents. Privately-owned plants, no matter how carefully planned and operated, may also have interruptions.

The only certain safeguard is an emergency lighting system that functions both instantly and automatically.

Electrical engineers agree that a storage battery, **properly maintained,** constitutes the most dependable source of emergency power.

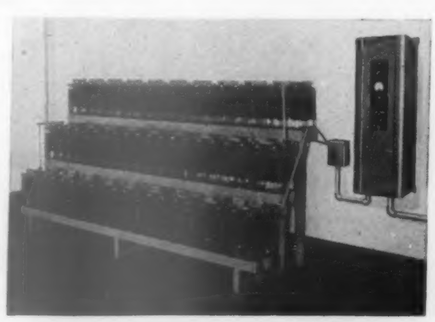
During an electric service interruption, Exide Keepalite furnishes the power from a dependable Exide Battery to the lights in auditoriums, gymnasiums, corridors exits, fire towers, stairways, engine rooms, locker rooms, swimming pools, dormitories, laboratories, etc.

Exide Batteries have been used in emergency service, by telephone, railroad and public utility companies since 1895. The new Exide Keepalite control equipment, which automatically keeps the battery properly maintained, represents the qualifications found desirable from the experience of more than 3000 installations in all kinds of buildings.

The exceptionally long life obtained from Exide Chloride Batteries used with the Exide Keepalite System assures many years of dependable emergency lighting service.

IT'S THE FIRST 60 SECONDS THAT COUNT
Exide Keepalite
EMERGENCY LIGHTING UNITS

A typical Exide-Keepalite System with a 60-cell Exide Battery and a 3450-watt Control Unit. It operates instantly and automatically. The infrequent addition of water to the battery is the only maintenance required



Exide
BATTERIES

THE EATON-DIKEMAN COMPANY

Manufacturers of Filter Papers

Mount Holly Springs, Penna.

LABORATORY FILTER PAPER FOR SCHOOLS, COLLEGES AND INDUSTRIES

FOR USE IN HEAVY AND LIGHT FUNNEL WORK, FILTER PRESSES AND FILTER MACHINES

E & D QUALITATIVE FILTER PAPERS

The Eaton-Dikeman Company, established in 1893, is today the world's largest manufacturer of quantitative, qualitative, and industrial filter papers; carrying in stock more than ninety grades of a quality that is dominated by the uniformity and purity that is found only in papers processed under a strict laboratory control and in a locality famous for the purity of its water and freeness from industrial and aerial pollutions.

The Eaton-Dikeman trademark assures you of a filter paper that is made from pure spring water free from chemicals and salts, that, if present, would prove harmful to many operations.

Eaton-Dikeman laboratory filter papers are sold by all laboratory supply dealers under their own special labels, as well as E & D labels. To be sure of obtaining E & D Quality, it is best to ask for the E & D label.

The qualitative grades are sixteen in number and are best described in our Descriptive Booklet No. 1, which we shall be glad to send you on request.

NEW FILT ANALYTICAL PAPERS

Our NEW FILT analytical grades, which we developed sometime ago, have been used by chemists the world over, giving excellent results. They were created to replace the foreign single-acid washed papers to be used for any analytical procedure where a strictly double-acid washed paper is not necessary. They are made of the very highest quality of pure cotton fibre and are specially treated and processed to insure a high degree of purity and a low ash weight. The NEW FILT grades, Nos. 1, 3, and 4, have an ash weight the equivalent of any single-acid washed imported paper.

NEW FILT papers have been approved by many testing laboratories and are being used in industrial laboratories throughout our country, Canada and Mexico.

Our Descriptive Booklet No. 2, useful as a laboratory handbook for analytical filtrations, describes these grades. A copy will be sent to you on request.

E & D FOLDED FILTER PAPER

Uniformity and purity, plus precision and speed make E & D folded papers the international standard.

The grades described below are stocked in all standard sizes 12.5 cm. to 60 cm.

- The No. 192 grade is rapid, yet retentive.
- No. 193 is medium fast, very retentive.
- No. 195 is very rapid.
- The No. 522 grade is highly retentive, good for general purposes.

E & D folded filter paper retains the fold in the funnel and the apex is full rounded, permitting an even distribution of the load, thereby preventing breakage at this point.

Packed 100 in a box. Samples sent on request. Ask for Descriptive Booklet No. 1.

E & D Qualitative and Quantitative papers are packed 100 circles to a box all sizes up to 20″ diameter.

E & D Lining Paper, Bibulous Paper and Filter Paper clippings are on stock.

OUR DESCRIPTIVE BOOKLETS NOS. 1, 2 WILL GIVE YOU A COMPLETE FILE ON LABORATORY FILTRATIONS. SENT GRATIS ON REQUEST

PHYSICAL CHARACTERISTICS OF MOST POPULAR LABORATORY GRADES

Grade	Color	Surface	Texture	Rapidity cc per Min.
607	White	Smooth	Med. Close	35-50
609	White	Smooth	Med. Close	30-45
612	White	Embossed	Med. Close	20-35
613	White	Smooth	Very Close	15-35
615	White	Creped	Fairly Open	75-150
617	White	Creped	Open	150-250
619	Gray	Creped	Fairly Open	75-150
620	Gray	Embossed	Fairly Close	45-70
629	White	Smooth	Med. Close	50-75

Note: Rapidity is number of cubic centimeters of distilled water filtered per minute in a 4″ 60° funnel.

LINTLESS FILTER PAPER
(Washed with Nitric Acid)

FOR FILTERING

- BIOLOGICALS
- SERUMS
- INJECTABLES
- INTRAVENOUS SOLUTIONS

- WILL WITHSTAND SCRAPING WITH SPATULA
- HIGH WET STRENGTH
- FOR FACILE TRANSFERENCE OF PRECIPITATES

EATON-DIKEMAN "Lintless" Nitric Acid Washed grades of filter paper are composed entirely of 100% cotton fibre and have been treated with nitric acid to produce lintless qualities necessary for various types of filtrations. They are extensively used in the filtering of all intravenous and subcutaneous injectables, as well as in laboratory filtrations requiring a paper having very high wet strength. These grades are packaged in the new dust-proof boxes to assure the chemist that the paper will arrive on his bench in the cleanest condition.

No. 850 grade has been washed with nitric acid, producing excellent lintless qualities along with very high wet strength. It is well adapted for vacuum filtrations of medicinal and biological solutions, requiring the highest degree of retention obtainable. This grade will retain particles as small as $BaSo_4$ precipitated in hot and cold solutions.

No. 852 grade. A hard surface paper possessing an excellent wet strength, approximately nine times that of a good grade of qualitative paper. This grade possesses a medium filtering speed and will retain medium sized particles, giving a nice polish to the filtrate. It is the intermediate between No. 850 slow and No. 854 rapid.

No. 854 grade. A tough hard surface filter paper having a very rapid filtering speed, retaining only the large sized particles. Its nitric acid treatment enables facile transference of precipitates and withstands considerable washing with acids and alkalis. This is the fastest in filtering speed of the nitric acid washed papers.

BARNSTEAD STILL AND STERILIZER CO., INC.

15 Lanesville Terrace, Forest Hills, Boston, Mass.

Original "BARNSTEAD" Water Distilling Equipment

Standard Water Stills for Laboratories
Extra Duty Stills for Hard Water Service

Storage Tanks for Distilled Water
Complete Line of Mountings and Accessories

1 gallon per hour electrically-heated still

1 gallon per hour steam-heated still

For more than 60 years, Barnstead Stills have been the outstanding laboratory water stills. Over 30,000 are now in use. Such Barnstead features as counter-current condensation, hot well and condenser venting, raw water preheating, splash proof baffles, extra large evaporators and pure block tin linings insure the highest grade of distillate. Copper and brass construction and the finest heating elements obtainable provide maximum efficiency and lowest operating and maintenance costs.

Finished in highly polished* nickel, Barnstead Water Stills conform with other laboratory equipment. Their sizes range from ½ gallon per hour up. Operation is by gas, steam, electricity or kerosene.

Extra Duty Stills for Hard Water Service

With the same capacities and operating elements as the Standard Models, Barnstead manufactures Extra Duty Type Stills for distilling water that is either badly contaminated or analyzes more than 50 parts per million total hardness. These stills have evaporators with extra large disengaging space to take care of excessive foaming and a constant bleeder device to prevent rapid scale formation in the evaporator.

Mountings and Accessories

Barnstead Stills can be mounted on stands, wall brackets, tables, shelves or concealed behind a wall. They are sold with or without storage tanks—metal or wood, tin lined—in many sizes. A full line of automatic cutoffs as well as self-starting, self-stopping and self-flushing controls are available. Write for complete 70-page catalog.

* Aluminum bronze finish over 3 gals. per hour.

1 gallon per hour gas-heated Extra Duty Still

Barnstead Still with storage tank and stand

STILLS FOR LABORATORIES—STANDARD AND EXTRA DUTY TYPES

STEAM-HEATED

Capacities 1, 2, 5, 10, 15, 20 and 30 gallons of distilled water per hour. All sizes are also furnished in the Extra Duty or hard water type. Evaporators are fitted with steam-heated coil. Steam at 40-60 pounds pressure should be used to heat Still. Stills to operate on lower pressures furnished to order. Require 9 pounds of steam and 8 gallons of cooling water per gallon of water distilled. Very economical in operation. Larger sizes up to 500 gallons per hour. When ordering, specify capacity required in gallons per hour, your steam pressure and type desired (standard or Extra Duty).

GAS-HEATED

Capacities ½, 1, 1½, 2, 2½, 5 and 10 gallons of distilled water per hour. Also Extra Duty models (for hard water) in all sizes. Stills are furnished complete with built-in gas burner and mixer. Flame is encased for high efficiency. Burners are adjustable for gases of 450 to 1100 B.T.U. value per cubic foot. Burners for other gases furnished to order at no extra charge. Require 9600 B.T.U. of gas heat and 8 gallons of cooling water per gallon of distilled water. When ordering, state capacity required in gallons per hour, kind of gas, and type desired (standard or Extra Duty).

ELECTRICALLY-HEATED

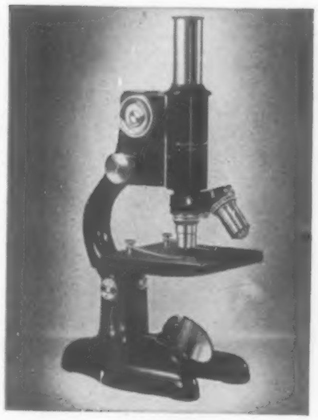
Capacities ½, 1, 1½, 2, 3, 5 and 10 gallons of distilled water per hour. A set of totally immersed electric heating elements permit very efficient heating. Elements are replaceable. The Stills are regularly furnished to operate on 110 or 220 volts alternating or direct current as specified. Require 2600 watts of electricity and 8 gallons of cooling water per gallons of water distilled. Very widely used in laboratories. When ordering, specify capacity required in gallons per hour, your voltage, and type desired (standard or Extra Duty).

BAUSCH & LOMB OPTICAL COMPANY

655 St. Paul Street, Rochester, N. Y.

New York — Chicago — Boston — Los Angeles — San Francisco
London, England — Toronto, Canada

FB MICROSCOPE



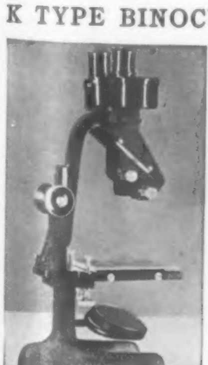
Microscope FB is especially designed and built for elementary science work and its price, based on quantity production, is in line with the most restricted budget. It is ruggedly built to stand many years of hard class room usage. Its optics are of the same precision type that characterize the more expensive research type of instrument. Features include standard size, coarse and fine adjustments, double revolving nose piece, standard objectives and eyepieces, disc diaphragm, solid Bakelite stage, concave mirror, etc. Velvety black, wear-resisting finish—Chromium plated parts.

Microscope F is similar to the instrument above but fine adjustment has been eliminated in the interests of economy. Magnifications range from 20 to 310 diameters.

CTA MICROSCOPE

This microscope is especially adapted for advanced Biological work, for Medical Study and Diagnosis and as a general purpose microscope in universities. Has inclined binocular body (interchangeable with monocular tube for photomicrography) with parallel eyepiece tubes. Built-on mechanical stage holds slides 50 x 75 mm., permitting examination of the entire area. Abbe Condenser 1.25 N.A. in full ring mount is in rack and pinion substage. Revolving, dustproof nosepiece, centered and parfocalized at the factory. Optical equipment of uniform high excellence includes achromatic and fluorite objectives.

K TYPE BINOCULAR MICROSCOPE



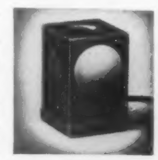
The great popularity of the K Type Binocular Microscope has prompted us to offer the Model "K" for schools and universities. Its range of magnifications of from 7X to 150X especially suit it for biological, bacteriological and paleontological work. An interesting feature of this series is the new dustproof Shuttle nosepiece, specially made for this series. This microscope gives stereoscopic, three dimensional effect. Image is upright and unreversed. Exceptionally wide field.

B & L REFLECTOR LAMP

This lamp fills a definite need in work with both the monocular or binocular non-objective microscope and the stereoscopic wide field microscopes. Elliptical mirror with adjustment provides diverging, parallel or converging light.

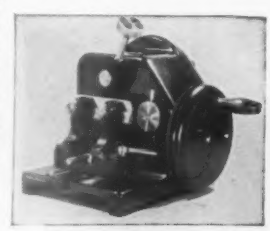
Jointed arm mounting permits all-angle illumination above or below stage. With adjustable transformer, light intensity is exactly adjustable to the work in hand.

OTHER MICROSCOPE LAMPS



Other B&L Microscope Lamps are available for various purposes in the school laboratory. The two shown herewith are (right) a substage lamp and (left) the Universal Microscope Lamp.

B & L MICROTOMES

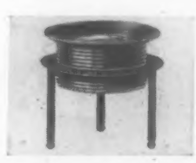


The B & L line of Microtomes is most complete. The Minot Automatic Rotary Microtome illustrated is ideal for rapid serial sectioning, cutting section with accuracy down to 1 micron in thickness. Feeding mechanism operates automatically. Dustproof operating mechanism. Catalog D-21 describes the complete line, including the new Precision Automatic Microtome—motor driven.

B & L SPECTROGRAPHS

The complete B&L line of Spectrographic Equipment covers every need. Models range from the Bunsen Spectroscope (illustrated) for elementary class room work to the large Littrow Spectrograph for examining complex alloys. Each is designed and built with the utmost care and due to our great experience in this field represents all of the best features necessary for both teaching and laboratory research. Catalogs D-221 and D-20 give complete detail.

QR MAGNIFIER



This is an adjustable tripod type magnifier which is placed directly over the specimen. Has double lens, magnifying 7.5X. Useful for the school laboratory. Other magnifiers for various purposes are available.

SEND FOR CATALOGS

For complete information on Laboratory Microscopes send for Catalog D-185. For information on B&L Balopticons see page 213 this catalog. Remember the instruments listed on these pages are but a small part of the B&L Line. If you have need for information on any optical products whatsoever, Bausch & Lomb will gladly be of service to you.

SPENCER LENS COMPANY

Buffalo, New York

Manufacturers of

Microscopes—Microtomes—Optical Measuring Instruments
Delineascopes—Photomicrographic Cameras

BRANCH OFFICES

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Spencer No. 66 Elementary Microscope

Since the start of this century many thousands of students have enjoyed first-hand experience with a microscope—have studied science by working with the tools of the scientists. Such observations will always be treasured memories.

As this book goes to press all of the greatly expanded Spencer facilities are concentrated on supplying optical instruments for the Armed Forces, war industries and Public Health. Only a small stock of No. 66 Elementary Microscopes is available. No more microscopes of this model will be produced during the war.

When the world is again at peace, a greater Spencer organization will be ready to serve you.

ALBERENE STONE CORPORATION OF VIRGINIA

Quarriers and Fabricators of Alberene Soapstone

Virginia Alberene Stone, Black Serpentine and Tremolite Green

419 Fourth Avenue, New York, N. Y.

Quarries and Mills at Schuyler, Va.

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ALBERENE SOAPSTONE

Natural quarried stone of medium hardness, blue-gray in color, produced and fabricated for more than 50 years; used in increasing quantities for:

- Table Tops and Backs
- Reagent Shelving
- Fume Hoods, Gutters
- Sinks, Drainboards
- Tanks and Tank Linings
- Toilet Partitions
- Shower Compartments
- Interior and Exterior Trim
- Door and Window Sills
- Fireplace Linings, Hearths
- Spandrels

ALBERENE TREAD STOCK

Selected stone of extreme hardness, reserved exclusively for Stair Treads, Landings, Platforms, and Flooring. Tests show an abrasive hardness factor of 25-40, the highest durability factor on the National Bureau of Standards scale of any natural stone commercially used for these purposes. Its siliceous nature makes it non-slip wet or dry.

GRADE 25 ALBERENE

Variety of extremely hard stone, especially selected for laboratory working surfaces. Takes a permanent high sheen when rubbed down with oil. Abrasive hardness factor, 25-40, National Bureau of Standards tests.

ALBERENE BLACK SERPENTINE

This natural stone is becoming extremely popular. Its great resistance to weather action makes it desirable for exterior as well as interior work. When sand-blasted (as in spandrels) the fine tracery of the designs stands out against the polished black surface. Abrasive hardness factor, 30-45, National Bureau of Standards tests.

ALBERENE TREMOLITE

An interesting addition to the line. In honed finish, shows clear white markings. Two varieties, one polishes to a dark green, the other to a dark blue-gray. Abrasive hardness factor, 25-40, National Bureau of Standards tests.

PHYSICAL AND CHEMICAL PROPERTIES

All grades of Alberene Stone are homogeneous and finely granular in all directions, dense and non-stratified, chemically resistant, impervious and non-staining. Alberene soapstone is easily machined—bored, slotted, grooved, tongued, turned—without splitting or spalling.

LABORATORY FIXTURE CONSTRUCTION

Alberene laboratory fixtures are practically one piece structures of solid stone. Table top slabs are united by a practically invisible joint employing a strip of non-corrosive metal cemented in grooves, with abutting slab edges sealed with acid-proof cement. Fume hoods, sinks and tanks are assembled with tongue-and-groove joints held by hidden bolts and nuts and cemented—permanently gas and liquid tight.

SERVICE IN DESIGN AND INSTALLATION

Every laboratory of major importance equipped in the past 50 years has used Alberene soapstone wholly or in large part. If you have a war training course you will undoubtedly need additional equipment. Let us help. We have the experience and the facilities.

MANUFACTURING FACILITIES

Quarries and mills at Schuyler, Virginia, are the largest in the world devoted exclusively to the production and fabrication of special purpose stone.

Section of Chemical Engineering Laboratory, Rensselaer Polytechnic Institute, Troy, N. Y.

Alberene Stone Stair Treads and Platforms in Woodrow Wilson High School, Washington, D. C. Nathan C. Wyeth, Municipal Architect

GENERAL CERAMICS COMPANY

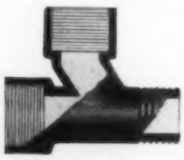
Manufacturers of Acid-Proof Chemical Stoneware Laboratory Equipment

Keasbey, New Jersey

New York Buffalo Los Angeles Portland San Francisco Seattle Tacoma Spokane Toronto Montreal

The Chemical Stoneware Division of General Ceramics Company makes a complete line of acid-proof chemical stoneware equipment for chemistry and physics laboratories in educational and research institutions, for general industrial chemical purposes, and for hospitals, electro-plating plants, newspapers, photo-engraving shops, and other establishments where corrosive fluids are used.

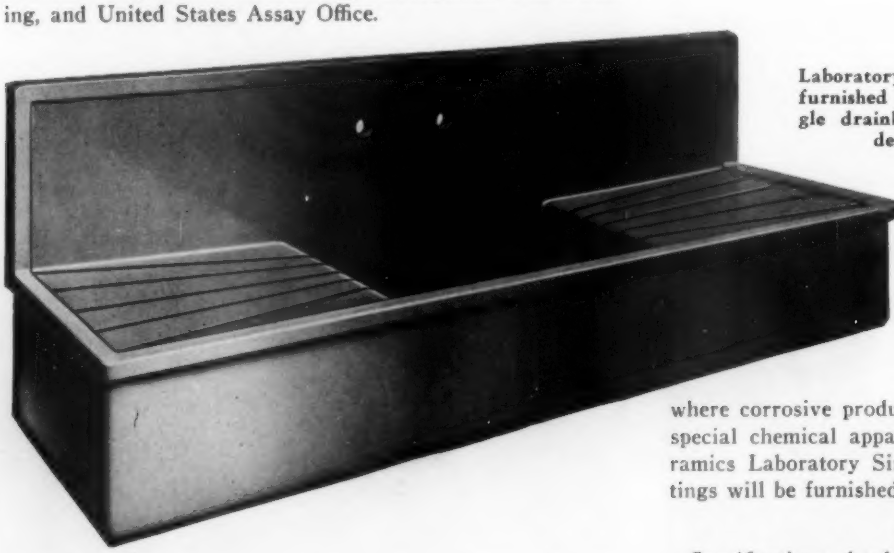
General Ceramics Chemical Stoneware Laboratory Equipment is widely used in educational institutions throughout the country. In fact, a list of the colleges and universities with chemistry laboratories equipped with General Ceramics Chemical Stoneware is practically a roster of our leading institutions of learning, including among many others Yale, Harvard, Vassar, Radcliffe, Duke, Pittsburgh, Wesleyan, Lehigh, Tulsa, Toledo, Berea, Purdue, Vanderbilt, McGill, California Institute of Technology, and the Universities of Maryland, Illinois, New Hampshire, Connecticut, Indiana, Pennsylvania, Ohio, Wisconsin, Nevada, California, and California at Los Angeles. General Ceramics equipment is used also in such buildings as the Walter Reed Hospital in Washington, the Curtis Publishing Company Building in Philadelphia, and in New York, the Times Building, Metropolitan Life Building, and United States Assay Office.



TY Fitting

Socket Pipe

Quarter Bend



The General Ceramics line of stoneware equipment includes laboratory sinks, drain lines and fittings, sumps, fume ducts, pumps, ventilating fans, and countless other items.

Description

General Ceramics Chemical Stoneware is a dense granite-like material with an attractive glazed surface. Both the glaze and the body of the ware are completely impervious to all acids and other chemicals, excepting hydrofluoric acid. The surface glaze is an integral part of the ware itself and therefore free from crazing and cracking. General Ceramics ware is mechanically strong, leakproof, and easy to keep clean, and it cannot contaminate the chemicals handled. It lasts indefinitely and there is no upkeep or replacement expense.

Laboratory Sink with integral back and side. Can be furnished without back and side in various types and sizes as required

Laboratory Sink with double drainboard. Can be furnished also without the integral back, with single drainboard (either right or left), and with details of construction as required

Engineering Service and Catalogues

Our Engineering Department will gladly assist in selecting the right stoneware equipment for any requirements. We cooperate in laying out laboratories and other buildings where corrosive products are handled, also in the design of special chemical apparatus. New bulletins on General Ceramics Laboratory Sinks and on Acid-Proof Pipe and Fittings will be furnished on request.

Specifications

Specifications should read as follows: "All parts of this installation subject to the action of acids or acid wastes are to be made of high-grade acid-proof chemical stoneware manufactured by the General Ceramics Company of Keasbey, N. J."

MAURICE A. KNIGHT

Acid, Alkali and Corrosion Proof Chemical Stoneware

227 Kelly Avenue, Akron, Ohio

55 West 42nd St., New York, N. Y.
618 Fidelity Bldg., Cleveland, Ohio
903 United Bldg., Niagara Falls, N. Y.

314 Stephenson Bldg., Detroit, Mich.
1934 Gravois, St. Louis, Mo.

203 N. Wabash Ave., Chicago, Ill.
1033 Merchants Exchange Bldg., San Francisco, Calif.
3465 Marlowe Ave., Montreal, Quebec, Can.

PRODUCTS

Acid Waste Pipe and Fittings
Acid-Proof Fume Ducts
One-Piece Laboratory Sinks
Acid-Proof Table Troughs
Neutralizing Sumps
Tanks, Jars, Filters, etc.

SOME INSTALLATIONS

Akron University
McGill University
Purdue University
Ohio State University
Brooklyn College
Princeton University
Northwestern University
University of Arkansas
University of Washington
University of California
University of West Virginia
Mellon Institute of Industrial Research

KNIGHT-WARE

Knight-Ware is an improved ceramic material that is dense, tough and wholly inert to the action of chemical solutions or gases, weak or strong, hot or cold (Hydrofluoric acid and hot caustic solutions excepted). Its acid-proof quality does not depend upon any glaze or surface treatment. "It is the body itself" that is entirely acid-proof. Knight-Ware equipment, properly installed, is trouble-free and permanent.

LABORATORY SINKS

Knight-Ware sinks are custom-made to specified measurements without extra cost. The one-piece construction, smooth surfaces, rounded corners and acid-proof quality mean a freedom from leaks and a cleanliness that is permanent. Splash backs, drainboards, aprons and outlets of several styles may be had as integral parts of the sink. Bottoms are sloped to insure complete drainage. The finish is a rich brown salt glaze that will not stain or peel.

ACID WASTE PIPE AND FITTINGS

Knight-Ware pipe and fittings are made in standard designs in any bore from 1 to 60 inches and straight lengths up to 5 feet. Special pieces to fit unusual places or to eliminate extra joints are available at low cost. Knight-Ware pipe is light in weight, strong and acid-proof.

Joints, packed and poured to our specifications, are tight and lasting.

KNIGHT-WARE FUME DUCTS

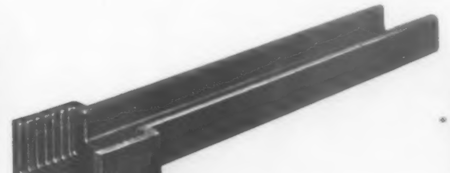
Ventilating pipe is available in round or rectangular shapes in bores up to 60 inches and with bell and spigot, flanged or plain butt end connections. Specify Knight-Ware for lasting protection.

SERVICE

If you are planning a new laboratory or modernizing your present one, we offer our knowledge and practical experience gained from scores of Knight-Ware installations.

Our fully illustrated Laboratory Equipment catalog will be sent upon request.

Fig. 237 RD Sink with right hand drainboard. Available with left hand or double drainboards and apron.



275A Table Trough

268 Knight-Ware S-Trap with Cleanout

PACIFIC FOUNDRY COMPANY LTD.

551 Fifth Ave.
New York

3100 Nineteenth St., San Francisco
(AGENTS IN PRINCIPAL CITIES)

1400 So. Alameda St.
Los Angeles

POST WAR PLANNERS: Write for a folder NOW. Send for Bulletins giving roughing-in dimensions, complete chemical and physical properties and list of installations in your vicinity.

LABORATORY PLUMBING AND VENTILATING COMPLETELY NON-CORROSIVE FOR ALL ACIDS* AND FUMES

INSTALLED IN LEADING SCHOOLS AND COLLEGES

WHAT CORROSIRON IS: An iron alloy, having a silicon content in excess of 14.25%, manufactured only by Pacific Foundry Company. A homogeneous alloy requiring neither treatment nor surface coating.

CHEMICAL PROPERTIES: **CORROSIRON** shows zero rate of corrosion when suspended in nitric acid or in nitrous fumes (two of most powerful corrosive agents known). Infinitesimal corrosion rates with all other acids* shown by tests by government and private agencies. Confirming, detailed data available on request.

WHERE USED: In high school, university, hospital and industrial laboratories for plumbing and fume exhaust systems in practically every state in the Union.

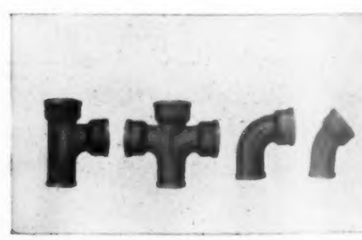
ITEMS AVAILABLE: **CORROSIRON** drain pipe and fittings (E. H. Std.) in all sizes. CORROSIRON fans, sizes 3 to 15 inch. Special acid handling equipment designed or furnished to your design.

REPUTATION: **CORROSIRON**, one of the first high silicon irons, has been manufactured and in satisfactory service for over 20 years. For more than a quarter century, Pacific Foundry Company has been building a reputation for quality rather than for quantity of the specialties which it manufactures. Full details of acceptance by Federal, State and school authorities on request.

USED FOR: Drain pipes and fittings, fans, laboratory acid digestion apparatus, sinks and other plumbing and fume exhaust systems.

Corrosiron Drain Pipe

Corrosiron Exhaust Fan



Corrosiron Drain Fittings

* Except hydrofluoric.

SPECIFICATION

All acid waste and acid vent piping shall be of approved high silicon cast iron bell and spigot type and shall contain: Not less than 14.25% and not more than 15% silicon; total carbon content below 1.12% and above .50%, manganese below .50%; sulphur below .05%

CORROSIRON

MADE IN U.S.A.

HIGH SILICON ACID RESISTING IRON

SECTION IX
SHOP PLANNING AND EQUIPMENT

WARTIME USES OF INDUSTRIAL ARTS LABORATORIES

—A SYMPOSIUM—

prepared under the direction of William E. Warner executive committeeman of the American Industrial Arts Association, Ohio State University, Columbus

A Study of Emergency Services in the Schools

By JOHN A. WHITESEL

Department of Industrial Arts Education, Miami University, Oxford, Ohio

CONSIDERABLE interest has been shown in the nature and extent of industrial arts contributions to the war effort, as well as in the ways that laboratories have adapted their space arrangements and equipment to meet these wartime programs. In order to determine what types of emergency services the demands of wartime have brought about in industrial arts laboratories, an inquiry was sent to more than 100 different high schools and teacher-preparation institutions throughout the country.

Modern Shop Planned for Flexibility

Before any critical study can be made of this whole problem, however, one should pause for a brief overview of the purposes for which such laboratories have been designed, and of some of the specific influences of the times upon shop layouts and equipment.

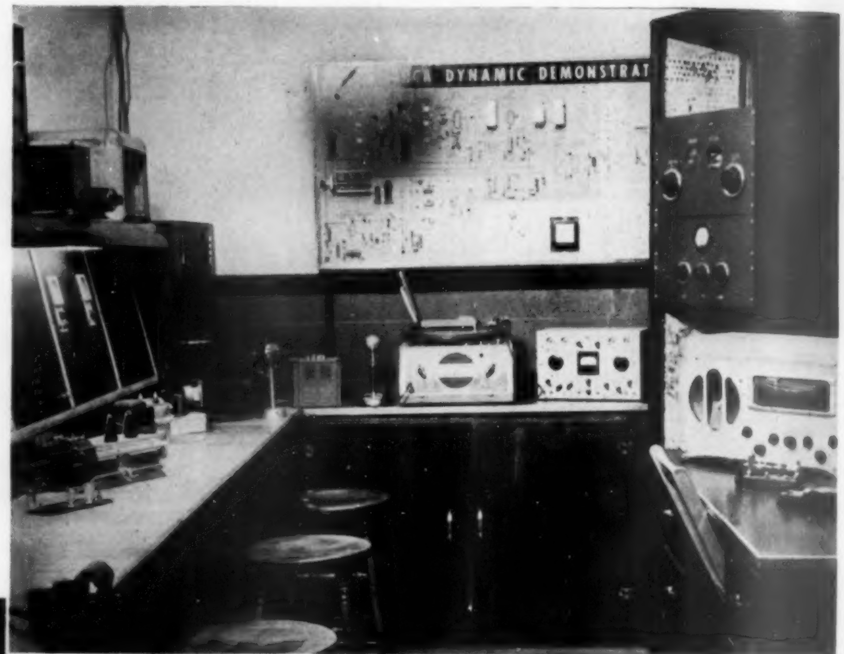
Purposes for Which Industrial Arts Laboratories Have Been Designed.—In recent, pre-war times, industrial arts laboratories have been designed and equipped for a society that is essentially democratic and highly industrial. Educational thinking today fosters the improvement of both individual and social living. The curriculum has become as broad as life experiences themselves. The school is changing rapidly from an institution concerned only with the children's accumulation of facts to a center of activity devoted to meeting the problems of all individual and group life in the community. The modern industrial arts program offers opportunities, through experiences with a wide variety of industrial materials, machines, tools, processes, products, and occupations, to gain ability and understanding in dealing with many of the problems of life.

Characteristics of Laboratory Layouts and Equipment.—Such a broad industrial arts program demands laboratories with areas and facilities for a wide range of industrial activities. One of the first principles of industrial arts laboratory planning is found listed in the *Ohio High School Standards—1937:*

> Any basic industrial process or material adaptable to pupil use should be considered as a suitable and desirable basis for an activity in an industrial arts laboratory. Laboratories containing areas of planning and drawing, photography, library, conference, finishing, woodworking, ceramics, crafts, experimental science, graphic arts, textiles, electricity, radio and communication, foundry, forging, sheetmetal, art metal, welding, machine metal work, and automotives including transportation have been found most adequate in establishing life situations.

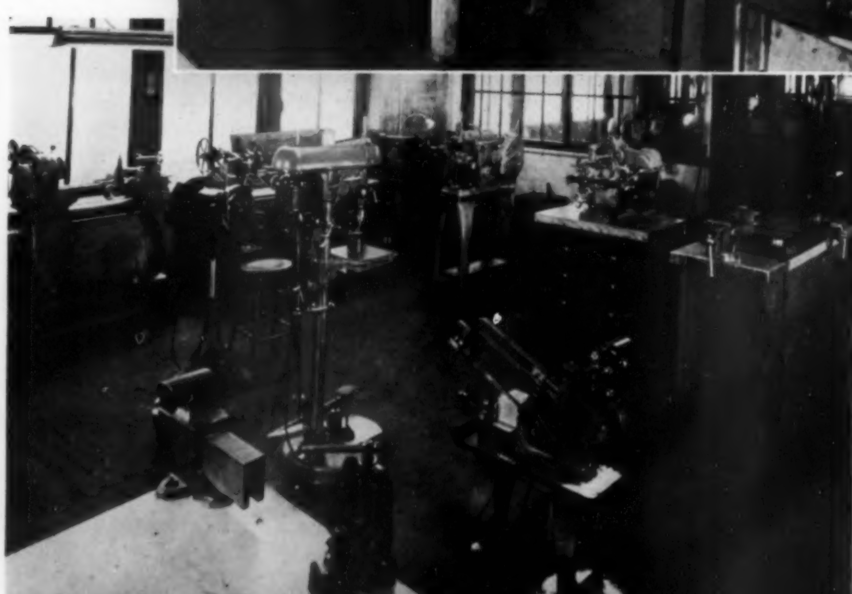
With respect to equipment selection, modern practices in industrial arts differ considerably from those of the manual training program of thirty years ago. Instead of purchasing an individual set of tools for each work bench, a much smaller number has been found to be adequate. This has permitted a selection of tools and equipment for a considerably broader variety of activities and experiences. Laboratories recently developed to allow for evening adult programs have placed more emphasis on machine-shop and other production equipment, with the thought of offering opportunities for preparation to enter production industries.

One of the leading principles of good shop planning is to make the arrangement flexible enough to meet the demands of changing programs. The shifting of equipment has been facilitated by such things as well-distributed service outlets, semi-portable machines with individual drives, temporary partitions within the laboratory, and extra, unassigned floor space in anticipation of future needs. The very nature of the industrial arts program itself has demanded that the laboratory arrangement be flexible and the facilities adequate for new problems which might arise. Such



Facilities for teaching radio theory at the Napoleon (Ohio) High School. The equipment is adequate for wartime work

The airplane sheetmetal section of the arts and industries laboratory at the Napoleon High School



Machine shop facilities for evening war production courses at the Napoleon High School. Equipment was expanded only slightly to carry on this program

trends in physical planning and equipment selection have aided the modern industrial arts program in meeting wartime emergencies.

Results of the Survey of Emergency Programs

Wartime Demands and Uses of Industrial Arts Laboratories.—From the sixty-four replies to the questionnaire received by the time this article was written, the programs or services seem to permit being grouped under such headings as defense and war production training programs; the Victory Corps and pre-induction programs; pre-flight aeronautics; subcontracting for wartime industry; general aviation or the "air-age" program; contributing to community and service agencies; radio and communication; glider programs; recognition or spotter programs and model building; aerial photography; wartime conservation and utilization of civilian equipment, and special emergency teacher-training courses.

The inquiry replies were studied not only for the different courses and programs being conducted, but also for the nature and purposes of such programs, and for the adaptability of the shop layout and equipment to the work. Photographs and laboratory plans have been used to exemplify conditions. Specific situations chosen from replies that seemed typical of the statements received from the inquiry have also been included. The writer only regrets that space has not permitted a thorough description and photographs of each school program studied.

Defense or War Production Training Programs.—Probably the wartime contribution which received most attention early in the emergency was defense training. Such work was financed both by the United States Office of Education and by local communities. There have been a number of such programs, one of which has been the Defense Training Program, and later the War Production Training Program. The courses have been intended primarily to prepare men and women for work in war production plants. Yet some courses, such as blueprint reading, have been designed to improve those already employed in production industry. The courses found listed in the inquiry replies were airplane sheet-metal work, automotive mechanics, aviation mechanics, blueprint reading, carpentry, drafting, electricity, foundry work, industrial inspection, machine-shop work, mathematics for machinists, metal work, pattern making, precision instrument work, power generation, riveting, welding, and woodworking.

While much of the work has been for out-of-school youth and adults, considerable emphasis has also been given to such courses in the regular day programs of high schools and teacher preparation institutions. Although the type of defense courses conducted has depended chiefly upon the demand in the community, usually the school selected for such classes was the one with the greatest amount of necessary equipment already available. The majority of persons replying said they were using the same equipment and space arrangement which is or was used in their regular industrial arts classes. Some had added equipment in order to accommodate more persons, while a few replied that their entire shop had been equipped by the United States Office of Education. In the cases where equipment has been added, usually it has been placed in previously unassigned floor space. On the other hand, in some crowded shops unessential equipment has been temporarily removed for the duration.

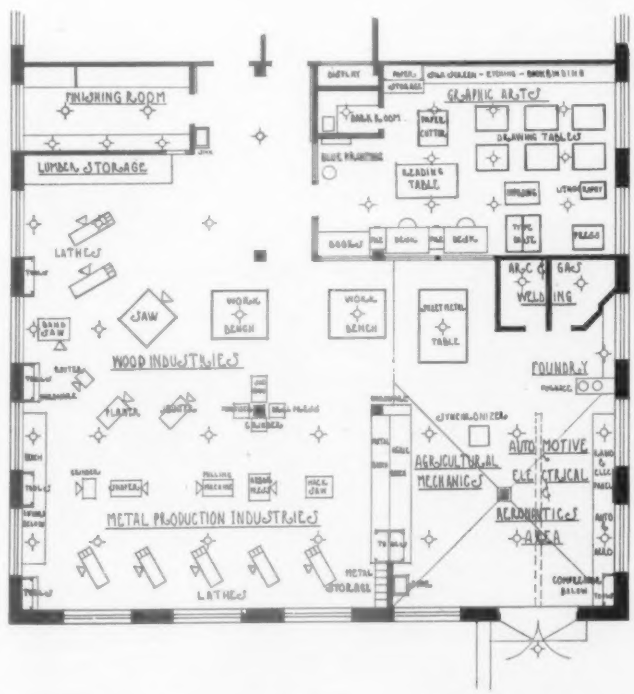
The Cincinnati school system reports that its equipment has been reasonably adequate. The foundries have functioned very well with the regular equipment except for the addition of a small melting furnace. Some additional equipment was installed in the machine shops in order to increase the number of training stations. A few production machines such as milling machines, shapers, grinders, and hack saws were also added.

The Cambridge (Ohio) program has carried on an extensive War Production Training Program. Three engine lathes, a planer, a surface grinder, three pneumatic riveters, electric drills, throatless shears, a spot welder, and other small equipment have been added to that laboratory. Most of these larger pieces of equipment have been placed in previously unassigned floor space arranged for in the plans.

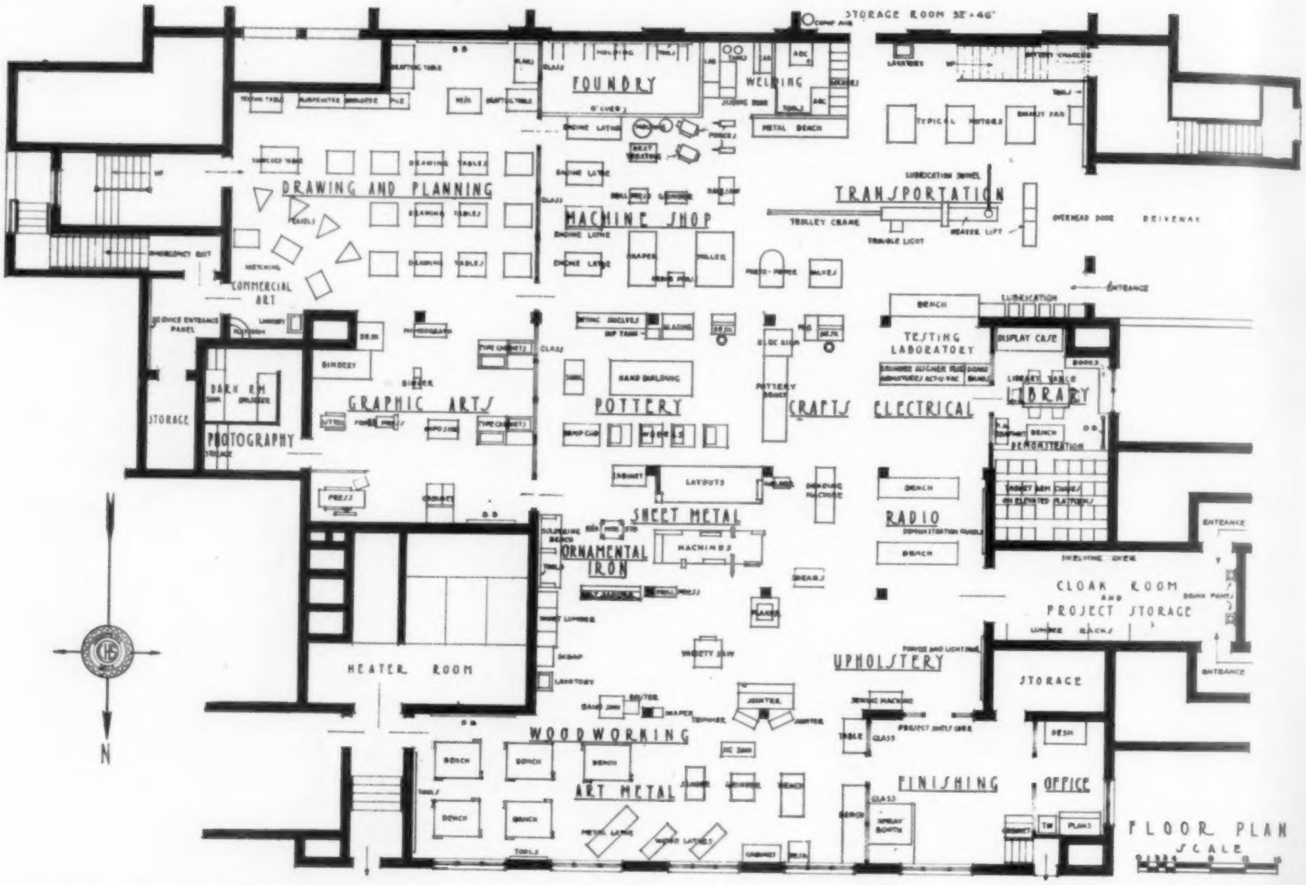
The Ray Technical School laboratory in Moodus, Conn., was designed in 1941 with the necessary space and facilities included for evening adult programs. Defense classes have been conducted there with no laboratory re-arrangement and with only the addition of more welding and photographic equipment.

Of the 65 secondary school industrial arts programs in Minneapolis, 20 had equipment satisfactory for war production training courses. Two machine shops in the industrial arts laboratories of the Hartford (Conn.) High School are being used by full time pre-employment trainees in general machine classes on three shifts, five days a week. Three high schools in that city are being used in a similar manner.

Poppenheusen Institute, at College Point, N. Y.,



Industrial arts laboratory, Ray Technical High School, Moodus, Conn., planned in 1941 to accommodate a broad industrial program for the regular students and adult evening classes of a small rural high school. Such a laboratory will meet the needs of most emergency wartime programs



This large arts and industries laboratory in the high school at Cambridge, Ohio, was designed for educational experiences in many different industries. It has been contributing in a variety of ways to the emergency with very little change in facilities

reports an extensive program designed to prepare trainees for specific jobs in local plants. Some additional equipment was installed in the machine-shop, while the aircraft sheet-metal department was entirely new.

The Napoleon (Ohio) program is a splendid example of a War Production Training Program. Classes have been held in radio, welding, auto-mechanics, sheet-metal work, machine-shop work, electricity, aircraft sheet-metal work, and blueprint reading. In radio, machine shop, and aircraft sheet-metal classes the equipment facilities were expanded slightly. In the other areas they needed no changes.

The West Virginia Institute of Technology has been offering defense training courses with no change in physical set-up except for the addition of a few government-owned production machines.

At Kansas State Teachers College, classes are held in machine-shop work, welding, and drafting to prepare persons for production in war plants. The courses are rather individualized to allow for the fact that the students have varying experience and goals.

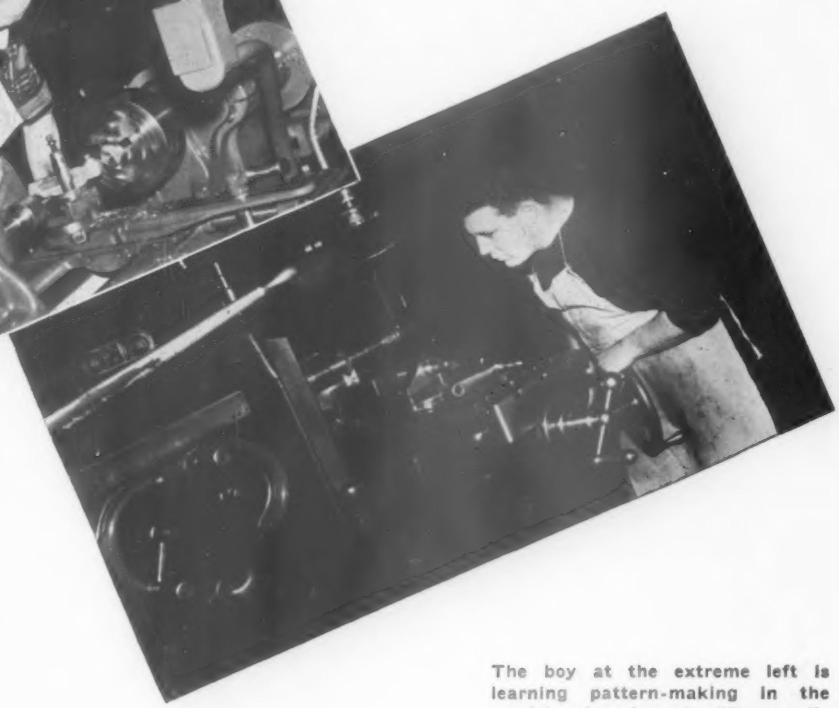
At Miami University defense and war production training classes are conducted in machine-shop work, welding, blueprint reading, drafting, and automotives. The only equipment added was an extension of existing facilities to increase the number of work stations.

Victory Corps and Pre-induction Programs.—One of the most recent contributions made by industrial arts is through the Victory Corps and pre-induction courses. Since this type of program is, on the whole, just beginning to get under way, much more can be expected of it during the coming year than has been forthcoming. The purpose of such courses in the last year or two of high school is that of preparing students for the armed forces or for war production. Those courses, preparatory to further specialization in the armed forces, include such work in the industrial arts area as fundamentals of radio, fundamentals of electricity, fundamentals of automotive mechanics, fundamentals of machines, and fundamentals of shopwork.

The Princeton (W. Va.) high school has 600 pupils taking the physical fitness program and soon will have 150 taking one of the following courses: fundamentals of shop, fundamentals of machines, fundamentals of electricity, and other courses to be announced. The courses preparing for war production are similar in character to those of the War Production Training Program, except that they are less intensive, and agriculture has been included in the program. The equipment and layout conditions, however, are much the same.

Pre-flight Aeronautics.—During the past year high schools over the nation have been asked to offer courses in pre-flight aeronautics similar to those already carried on in colleges for the past two years. While much of the work is being carried on in the mathematics and science departments, the equipment

Boys at work in the machine shop of the industrial arts laboratory of a Dayton, Ohio, school are shown at left and below. The Dayton schools have been doing subcontracting for some of the local war industries

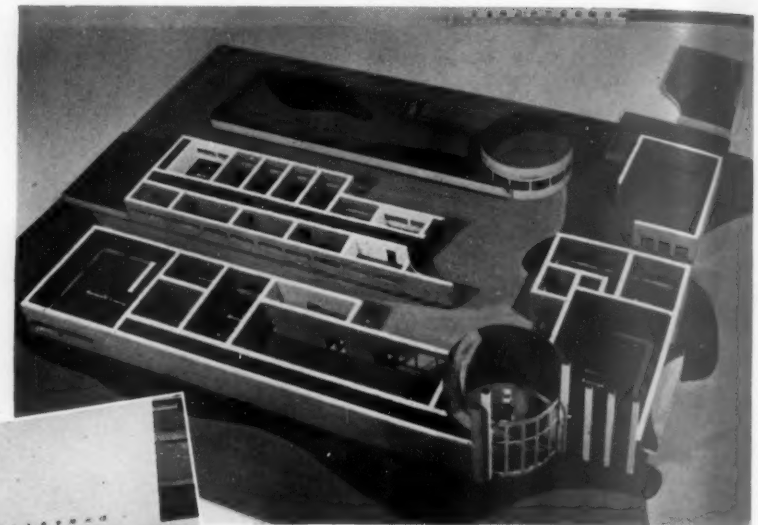


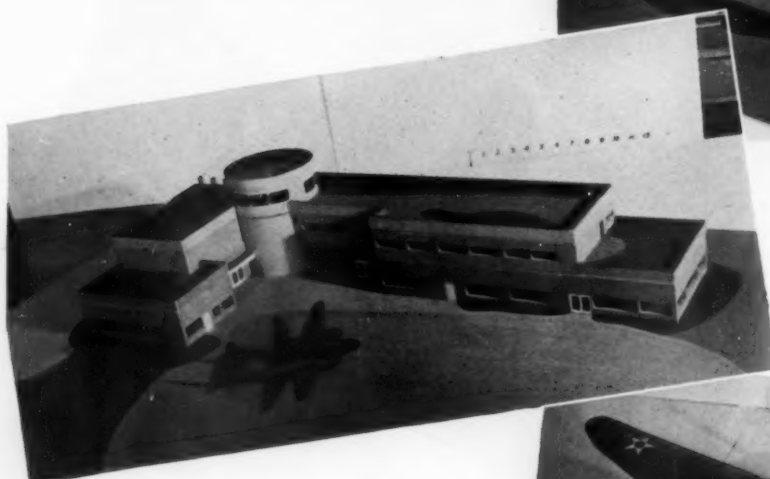
The boy at the extreme left is learning pattern-making in the wood-turning shop of a Minneapolis school. Below, a Minneapolis boy is getting milling machine practice

The work of a Minneapolis class in aviation sheet metal is being inspected by officials in the picture above

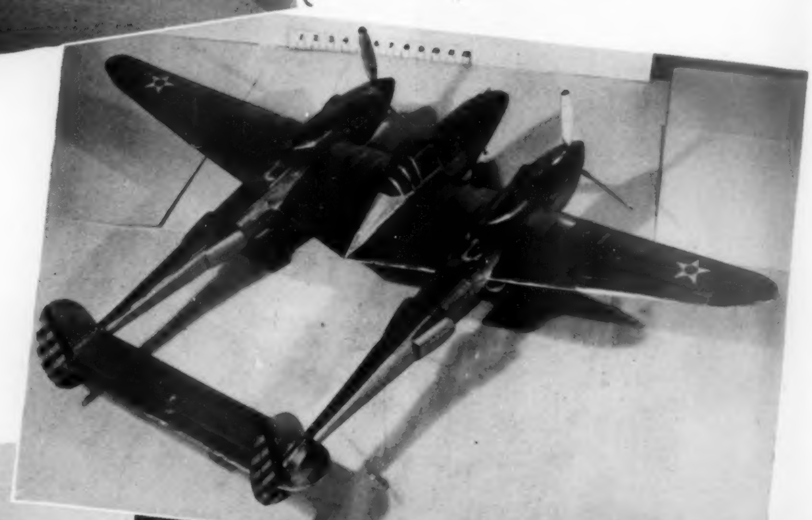
Pictured on this page are products of the industrial arts laboratories at Ohio State University

At right and below are views of a model for the administration building of a flying field

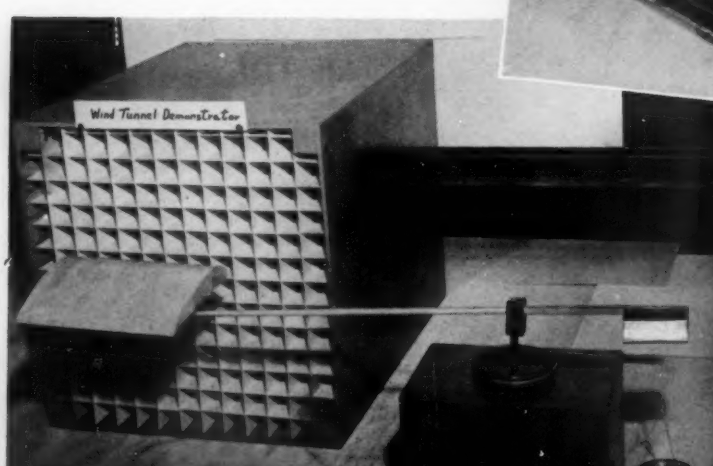


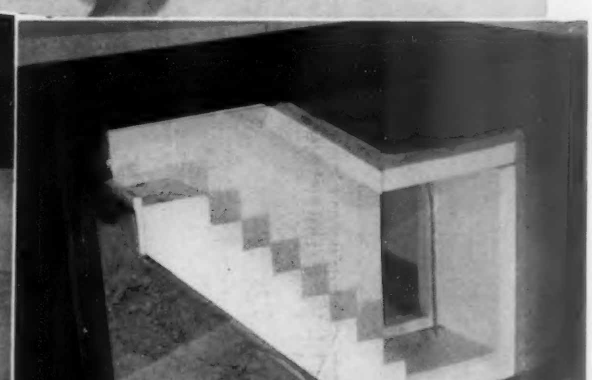


Shown below is a student-built P-38 plane model



Students made the wind tunnel demonstrator, below left, and the bomb shelter model, below right





and facilities available in industrial arts laboratories have enabled this area to render valuable service. Much of the equipment used in pre-flight aeronautics experimentation may be constructed by the pupils themselves. The industrial arts and science departments can usually cooperate in constructing and experimenting with the same device. This is the type of program described by many of the inquiry replies.

The Yonkers (N. Y.) program has three new and well-equipped centers in the senior high school industrial arts laboratories for carrying on pre-flight classes in aircraft engines, structures, communication, devices, propellers, accessories, parachutes, airport organization, meteorology, navigation, simple aero-dynamics, theory of flight, civil aeronautics regulations, guidance and occupational information, and the identification of planes.

Subcontracting for Wartime Industry. — Five schools report industrial arts classes doing subcontracting work for wartime industry. These schools are the California (Pa.) State Teachers College; the Lancaster (Ohio) High School; the Dayton (Ohio) Public Schools; the Poppenheusen Institute, College Point, N. Y., and the Trenton (N. J.) State Teachers College. While most industrial arts laboratories have made their contributions in other ways, this does show one way that the equipment may be used to contribute toward the war effort.

Contributing to Community and Service Agencies. —One wartime use of industrial arts laboratories open to practically all schools with shop programs is that of contributing to community and service agencies. Examples are the making of such things as first-aid boxes, splints, stretchers, games, game tables, writing desks, ash trays, bookshelves, and cots for the Red Cross and USO organizations; the printing of materials for civilian defense organizations, for the development of the Victory Corps program, and for USO benefits; the making of posters for air-raid protection; the cutting of scrap iron collected by student-community drives; and the building of obstacles and other equipment for physical training programs.

The Stonewall Jackson High School industrial arts classes at Charleston, W. Va., exemplify many such programs. They have been making a variety of such items as metal ash trays for the Junior Red Cross, to be used in hospitals; signs by printing, painting and silk screen processes, to be used at street intersections to direct the public to air-raid shelters; electric light panels for air-raid warden posts, and printed instructions for community drives and civilian defense.

A definite "win-the-war" program is functioning in Newark, N. J. It contributes to aeronautics, salvage of materials and products, aid to service organizations, shop improvement, and individual projects. The result is greatly increased group activity, pooling of requests from service organizations, and contributing to the limit of the laboratory's capacity without defeating its educational objectives.

While occasional jigs are needed for the quantity production of items for service organizations, seldom is any new equipment purchased or any major layout changes made for such contributions by industrial arts classes.

Air-Age Program.—Leaders of our nation have recently realized that while airplanes have been with us for over thirty years, the public has not awakened to the extreme importance of aviation to our civilization. As a result our schools have been asked to do everything possible throughout the entire program to arouse an awareness of the airplane and its significance, and to bring about a better understanding of aviation technics, processes, terms, and customs. The industrial arts offer an excellent opportunity for experimental studies and activities in general or consumer aviation.

An example of an outstanding air-age program is the one at the Ohio State University in the general shop or Laboratory of Industries orientation course given to the university freshmen majoring in industrial arts education. All such experimentation and constructive activity is conducted in the regular laboratory with no changes in layout or equipment except for the construction of minor items by the students themselves. This is made possible by the richness of the physical setting itself.

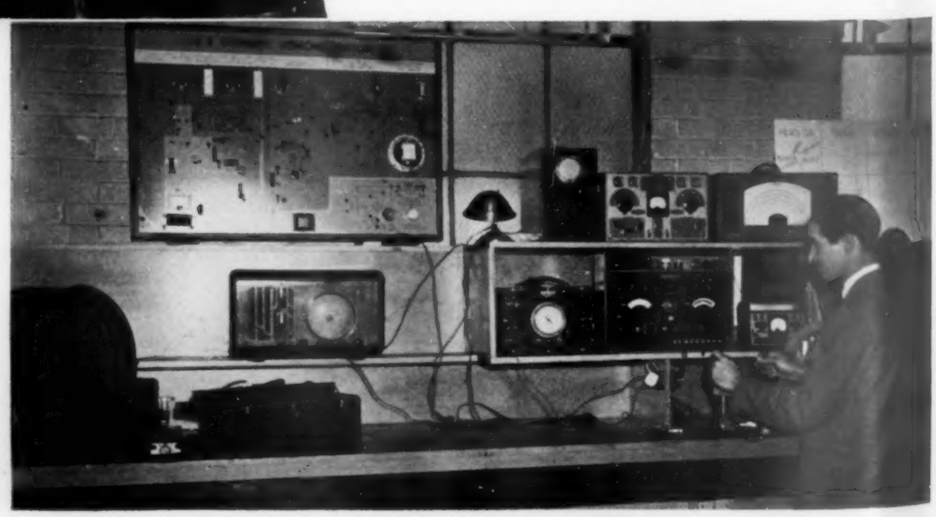
Radio and Communication.—A number of industrial arts laboratories are conducting classes in radio to prepare students for special service in the armed forces. Such courses include code and blinker-light communication, the theory of radio, and radio maintenance or repair. Miami University conducts such a program, not only for students, as pre-induction work, but also for Naval trainees. As far as equipment is concerned, code may be taught in regular classrooms, while radio theory and maintenance may be carried on with the regular radio facilities of a modern broadly equipped industrial arts laboratory.

The Worcester, Mass., report states that the radio work offered in the schools this past year has had unusual success. The objectives of the course are: first, to teach the fundamental theories underlying radio telephony and radio telegraphy; second, to develop the students' ability to read and understand wiring diagrams; third, to teach the International Morse Code and operating technics; and fourth, to help prepare the students for government examinations. Because no radio courses had been previously given there, it was necessary to purchase all new equipment.

Glider Programs.—Three of the programs studied were found to be using glider construction as a wartime contribution in their industrial arts laboratories. They are the Minneapolis high schools, Poppenheusen Institute, and the North Carolina State College. Beginning with next semester, all the students majoring in industrial arts education in the North Carolina State College will take part in glider construction. While this type of work requires practically no new equipment, certain jigs easily constructed by the students are practically essential. The fact that considerable space is necessary for the assembling of the glider has prevented many shops, especially those in crowded city schools, from undertaking glider construction projects.

Recognition or Spotter Programs and Model Building.—A program which is easily conducted in most industrial arts laboratories is the building of model airplanes for the Army and Navy, the building of spotter models, and the giving of recognition courses. All but a few of the school programs studied have built some models. In many cases this project has been one of mass production. The work can be car-

Activities in the plane spotter course at the Weequahic High School, Newark, N. J. Above—Identifying planes. Below—making slides for plane identification. Left—projecting lantern slides with the aid of a 45° mirror, for plane identification training



Radio equipment used at Miami University for emergency war-time courses for regular students and naval trainees

ried on in the regular woodworking area of the laboratory without any shifting of equipment.

The Oklahoma schools have furnished an example of the Model Aircraft Production Project. The state director of the project recommended that all high-school woodworking classes be started on a unit of model plane building, and that every boy attempt to build at least one model plane. Two hundred forty-three schools in Oklahoma accepted quotas totaling slightly more than 10,000 model planes to be built.

Dixie Heights High School, Kenton County, Ky., reports that its students have completed 100 planes and have volunteered for 100 more which are now under construction. This was done with no shift from the ordinary laboratory arrangement.

The Pine Manual Training School of Ansonia, Conn., has been a leader in model plane building in that state. There have been no equipment changes for that program.

The Weequahic High School in Newark, N. J., has been conducting plane recognition or spotter courses. Much of this has been done with lantern slides and wall charts. Very little major equipment, except a projection lantern, has been needed.

The St. Cloud (Minn.) State Teachers College report states that all pupils in its training school, and the college group in beginning woodwork, have been cooperating in the identification model plane program and are using the regular industrial arts equipment for their work.

Aerial Photography.—Only two schools report that they are conducting courses in aerial photography. They are the Wyoming (Ohio) High School, and the Greenwich (Conn.) High School. In the Wyoming High School photographs are taken from high buildings or from kites made for that purpose. The fundamentals of aerial photography can be taught in a classroom and in the photographic darkroom usually included in modern industrial arts laboratories.

Wartime Conservation and Utilization of Civilian Equipment.—While no replies to the inquiry called any of their wartime contributions "emergency conservation and utilization of civilian equipment," it was found that a number of schools were doing just that thing. Some programs include home mechanics courses, which teach how to make the usual necessary repairs about the house. A number of laboratories are being used for automotive maintenance courses with the aim of teaching students to help keep our chief method of transportation working. Others are used for courses in repairing and protecting farm machinery that is now in use.

Berea College at Berea, Ky., has been offering courses in radio maintenance. Since our radios cannot be replaced for the duration of the war, it is quite important that the ones we have are kept in service.

Emergency Teacher Preparation Courses.—Two replies from teacher preparation institutions in New Jersey listed as one of their wartime contributions special courses for the training of emergency industrial arts teachers. These particular industrial arts programs were in the State Teachers Colleges at Newark and Trenton. The Newark institution reports recruiting and training men who are not in the draft, or who do not expect to be called, to man the shops for those who are being inducted. Over 100 persons have already been given or are now being given such emergency training courses. Practically all who have taken these special evening teacher preparation courses are at this time teaching in industrial arts shops. Naturally the colleges were already designed for teacher preparation work, so that no changes have been necessary in laboratory layout and equipment.

Conclusions and Comments

This wide variety of contributions has been made for the most part with little or no change in laboratory layouts and equipment. The one activity requiring the greatest number of additional facilities has been the Defense or War Production Training Program.

The industrial arts teachers as a whole seemed to have entered wholeheartedly into the various wartime programs. While an effort has been made to meet all emergency needs possible, it has seemed to the writer that more emphasis might well be placed on the importance in wartime of conserving the industrial products we now use daily and which cannot be replaced for the duration.

The inquiry findings seem to show that any rich program of industrial arts will make possible a wide range of wartime contributions. Furthermore, any well designed and equipped peacetime laboratory will be, with little or no change, suitable and adequate for accommodating wartime courses and programs.

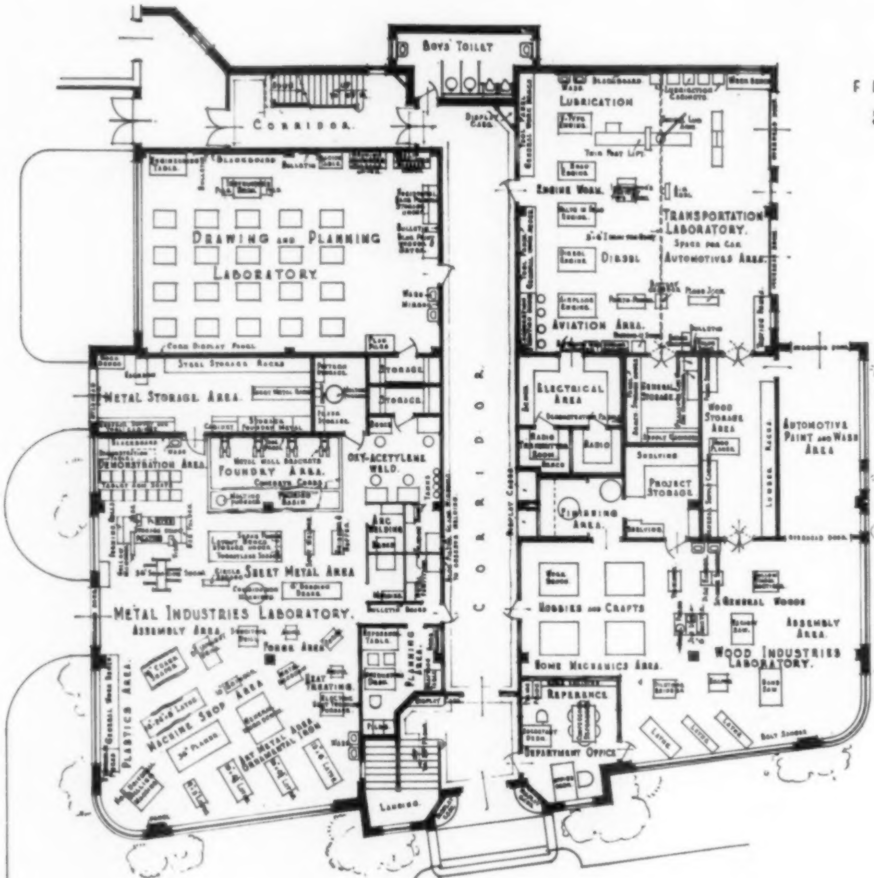
Flexibility in a Medium-Size Laboratory

By PAUL A. LERNER

Supervisor of Industrial Arts and Director of War Production Workers Training School Troy (Ohio) Public Schools
Now Lieutenant (jg), A-V (s), U.S.N.R.

A MODERN arts and industries laboratory set up during peacetime is flexible enough in its arrangements to provide training facilities for almost any wartime duty it might be called upon to perform. An interesting example of this is the Troy laboratory, especially in view of the fact that the work is being carried on with modernized facilities in the existing high-school building instead of in the $125,000 Arts and Industries Building which had been planned by the school officials, but on which construction has been postponed until after the war.

Our modernized arts and industries laboratory is

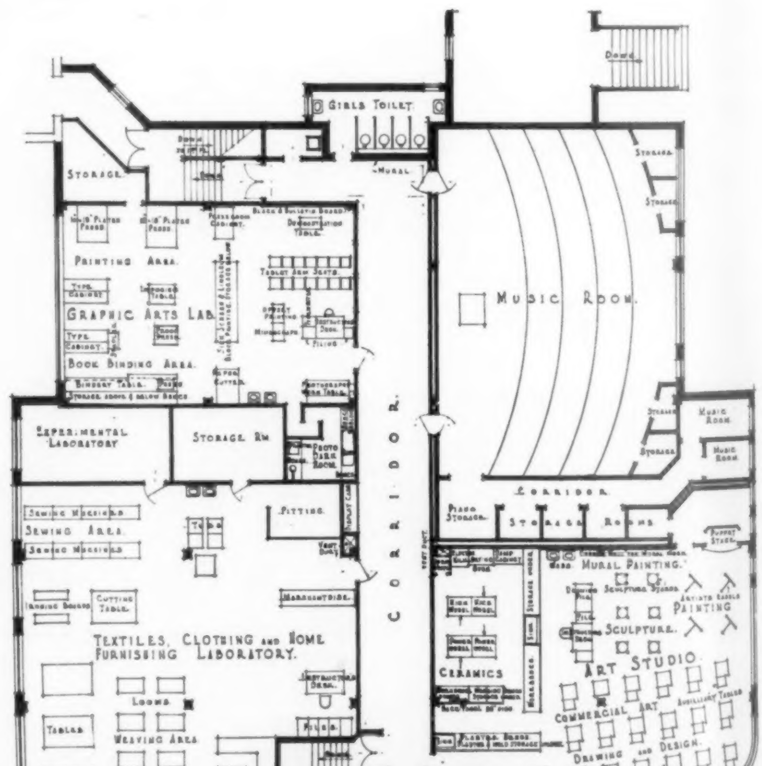


FIRST · FLOOR · PLAN ·

SCALE IN FEET

Plans for Arts and Industries Building, Troy, Ohio. Construction to take place after the war

Pretzinger & Pretzinger, Architects



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SCALE IN FEET

equipped for instruction in woodworking, radio and electricity, sheet-metal work, gas welding, electric arc welding, machine-shop work, forge and heat-treating work, foundry practices, drawing, planning, drawing reproduction, drafting, blueprint reading, and the application of finishes. Areas are also provided for tools and supply storage and for an instructors' office. The laboratory is operated entirely by student personnel, from the time students report for roll call until the final check-up and dismissal. Some 200 high-school students have been trained in industrial arts during regular school hours.

Local Industries Ask School for Help

About the time the new equipment was installed, the local industries began receiving large contracts for war materials. In most cases their employee rolls were tripled as a result of the influx of new work. The industries, unable to obtain a sufficient number of skilled workers, appealed to our school for assistance in training new personnel. As a consequence, about 500 adults trained in our arts and industries laboratory are now holding responsible positions in war production plants all over the United States.

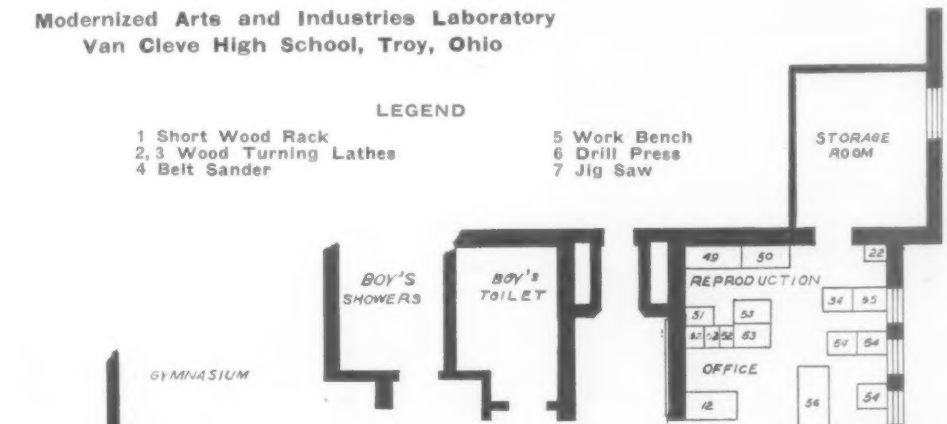
Description of the Laboratory Facilities

Wood Industries Laboratory.—Troy is the home of one of the very large manufacturers of wood and metal transport planes and gliders for the armed services. Our training program ranges from the building of models in the elementary and secondary schools to the building of a life-size glider wing by a group in the night adult training school. During the past year our school has trained about 50 men and 100 women to qualify as skilled workers in a variety of aircraft woodworking operations.

Radio and Electricity.—Instruction in radio and the fundamentals of electricity are provided as part of the instruction. The importance of this branch of the work cannot be overestimated when one considers the broad use of electricity in the armed forces.

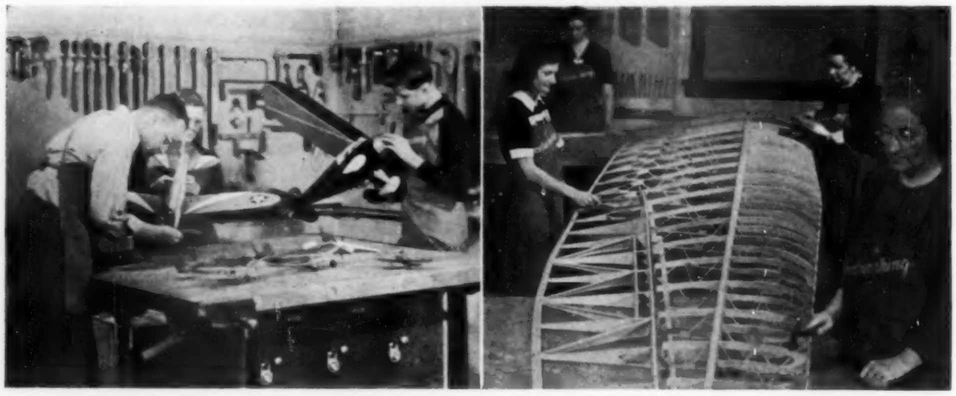
Sheet-Metal Work.—The sheet-metal layout and construction laboratory is equipped with such modern equipment as an electric sheet-metal shear, a spot

Modernized Arts and Industries Laboratory
Van Cleve High School, Troy, Ohio



LEGEND

1 Short Wood Rack
2, 3 Wood Turning Lathes
4 Belt Sander
5 Work Bench
6 Drill Press
7 Jig Saw
8 Jointer
9 Mortiser
10 Shaper
11 Trimmer
12 Instructor's Desk
13 Saw Table
14 Spindle Sander
15 Disc Sander
16 Band Saw
17 Oilstone Grinder
18 Planer
19 Spray Booth Stand
20 Finishing Bench
21 Project Storage Shelving
22 Storage Cabinets
23 Wood Panels
24 Foundry Metal Storage Bins Under Bench
25 Hacksaw
26 Steel and Lumber Racks
27 Long Work Bench, Storage Under
28 Arbor Press
29 Engine Lathes
30 Shaper
31 Anvils
32 Forge and Heat-Treating Furnace
33 Heavy-duty Grinder and Buffer
34 Tool Grinder
35 Radial Drill
36 Electric Welding Machines
37 Electric Welding Benches
38 Gas Welding Benches
39 Gas Welding Stools
40 Combination Machines Stand
41 Sheetmetal Forming Machine Bench
42 Spot Welder
43 Soldering Bench
44 Sheetmetal Layout Bench
45 Sheetmetal Bending Brake
46 Circle Shears
47 Squaring Shears
48 Storage Cabinet
49 Horizontal Type Printer
50 B-W Developer
51 Blueprint Washer
52 Filing Cabinets
53 Typing Desks
54 Drawing Tables
55 Plan File Cabinet
56 Conference Table
57 Library Shelving
58 Magazine Rack, Bulletin and Blackboard
59 Electric Bench
60 Radio Bench
61 Foundry Pattern and Storage Cabinet
62 Acetylene and Oxygen Supply
63 Foundry Pouring Basin
64 Melting Furnace
65 Wall Bracket-Type Bench
66 Sheetmetal Storage



Left—Wood industries laboratory. Trainees in the evening school work on a glider wing. High-school students building model airplanes are shown at the extreme left

Left and below—Sheet-metal area. Below left, a group of students are studying an aircraft sheet-metal layout on the layout bench. Below right, students are working sheet-metal forming machines

Above—a general view of the modern equipment in the sheet-metal area

Left — Radio and electricity area. The student at the extreme left is repairing an auto radio. The other boy is fixing an electric motor

Extreme left—Transportation area. Students are repairing an automobile engine. Automotive tools hang on wall panel behind them

Left—Gas welding area. War production training students are welding aircraft parts

welder, portable oxy-acetylene welding equipment, circle shears, etc.

Automechanics.—Since one of the major needs of the armed forces is for men trained in engine mechanics, rather than in the broader field of automotive mechanics, we purchased two new-model automobile engines and mounted them on steel stands, instead of cutting a door in the wall to admit complete automobiles into the shop. Before the engines were completely installed, however, the school received a call from local industries to help meet the demand for trained oxy-acetylene welders. We immediately removed the engines to other quarters and proceeded to provide the training facilities for the welders. As soon as we have trained enough gas welders to take care of war production needs, we plan to set up the automobile engines again, in the space which is shown on the accompanying floor plans as accommodating welding tables.

The operation of the "L-head" engine was taught on the Chrysler six-cylinder engine with fluid drive. The operation of the "valve-in head" engine was taught on the Buick eight-cylinder engine with dual carburetion.

Gas Welding.—Our industrial arts class built the necessary welding tables and stools. It was decided to centralize our gas supply and pipe the oxygen and acetylene to each individual station to save the use of several cylinders. We also decided to purchase five makes of torches in order to give the trainees experience on the different makes of equipment. This arrangement of the equipment has proved very successful. We have trained some 50 gas welders to date.

Electric Arc Welding.—A partition built by the students provides four booths for arc welding instruction. The partitions of the booths start one foot from the floor and run to the ceiling, protecting other students from "flash." Each booth is provided with a sliding door and forced-draft ventilation. The partitions are used on both sides for equipment panels.

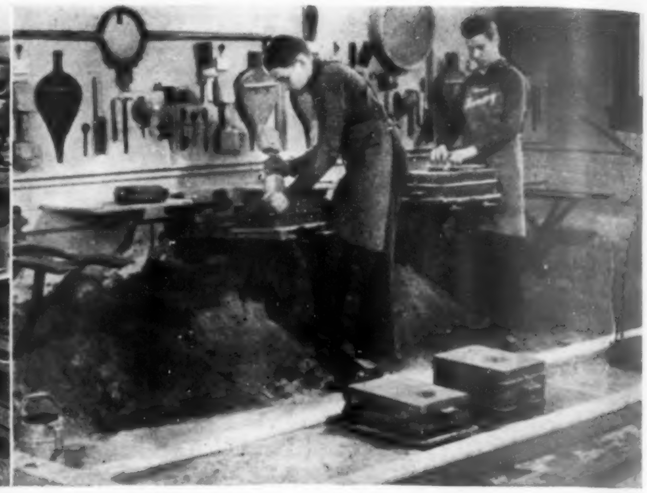
This arc welding equipment is operated full time to give the day-school students a knowledge of the art of "stitching" metal. The war production workers' school makes full use of the equipment at night.

Machine-Shop Practice and Forge and Heat-Treating Work.—The arrangement of equipment permits variety of instruction in machine-shop practice as well as in forge and heat-treating work for both the high-school students and the adult general metals training class. In spite of limited equipment we can boast of some 60 trainees, trained during the past year, who are now producing war material.

Foundry Practice.—One end of our laboratory has been converted into a modern foundry area. The arrangement keeps sand on the floor as in industry, but confines it to the foundry area by means of a 4-in. concrete curb.

Each student has his own wall-bracket-type molding bench, which is adjustable for various heights. A gas-fired furnace is located within the pouring basin;

The electric welding booths are built of angle iron and plywood. Welding accessories are mounted on the inside of the panels, above left. Machine shop tools are mounted on the outside, as shown in the center photo. A student is learning the art of "stitching" metal inside the booth at the right



Above left—General metals class. War production training school adults learning the machine trade. Above right—Foundry area. Students getting ready for molten metal on the gas-fired furnace

Below left—Planning area. War production trainees are studying aircraft blueprint reading. Below right—Drawing area. Shown in the picture is some of the equipment used for reproducing drawings

Above—The forge and heat-treating area. High school students are practicing their skill

Left—The instructors' office. Modern office equipment is provided for the administration of the laboratory

a forced-draft ventilating hood is mounted over this furnace to remove the fumes.

Drawing and Planning Area.—The planning area is provided with drawing tables, a reference library of about 500 books, a plan file cabinet, a conference table, a horizontal-type printer, a developing machine for semi-dry prints, and a blueprint washer for developing blueprints.

Instructors' Office.—The instructors are provided with modern office equipment consisting of office desks, a typewriter desk, and filing and storage cabinets.

Modern Stock Area.—The stock of materials and precision tools is concentrated in one room, of which a student stock clerk is in charge. All stock is issued by student stock orders, and precision tools are lent on presentation of a loan record form. A permanent record system of cards maintains a complete record of the quantity of each item in stock.

Finishing Area.—A spray booth is provided for the application of all modern finishes. It is ventilated by forced draft and has special fluorescent lighting. Storage cupboards and tables are provided for hand finishing.

A Large City's Laboratories Meet the Test of War

By LOUIS V. NEWKIRK

Director, Bureau of Industrial Arts Education, Board of Education, Chicago, Illinois

INDUSTRIAL arts laboratories in the Chicago school system have expanded rapidly during the past six years. Over 260 new laboratories have been installed during this time in the grades ranging from the 6th in the elementary school through the 11th in the general high schools. Over 80,000 boys and girls now receive instruction in this program.

The first obligation of Chicago's industrial arts laboratories is to give boys and girls educational experiences with tools and materials so that they will have the foundation and insights necessary to success when they enter the more specialized training of the vocational, professional, or business school. Nevertheless, the boys and girls have been able to make many contributions to the Red Cross, the USO, the Army, the Navy, and civilian defense by substituting projects of value to the armed forces for personal projects. For example, a boy or girl will make a model airplane for the Navy instead of a book rack.

During the past two years the boys and girls taking part in the Chicago industrial arts program have made 30,000 items for the Red Cross, 12,000 games for the USO, 18,000 scale model planes for the United States Navy and civilian defense. They are now making plans to build model tanks to be used for recognition and sighting by men training for tank warfare and gunnery.

The boys and girls in the 6th, 7th, and 8th grades have not only built many items for the armed services, but they have also learned to repair such essential pieces of equipment about the home as vacuum cleaners, locks, and faucets.

The Three Different Types of Laboratories

Since our laboratories are quite flexible, it has not been found necessary to modify the equipment to meet wartime conditions. The Chicago program of industrial arts laboratories includes the Home Mechanics Laboratory (grades 6, 7, and 8); the Industrial Arts Laboratory (grade 9); and the Laboratory of Arts and Industries (grades 10 and 11 in general high schools).

The Home Mechanics Laboratory.—This course is designed to replace those in manual training and household arts. It was introduced experimentally in 5 elementary schools in 1938-39, when over 1,000 boys and girls in Grades 7 and 8 took the work. The Home Mechanics Laboratory has now been installed in 140 elementary schools, and over 60,000 boys and girls received instruction in 1941-42.

Laboratory Equipment and Tools.—The typical Home Mechanics Laboratory is 50% larger than the average classroom and is equipped with new, especially designed, metal school furniture. This equipment includes 6 large work-tables and stools; 2 work-benches with vises; tool and storage cabinets; and

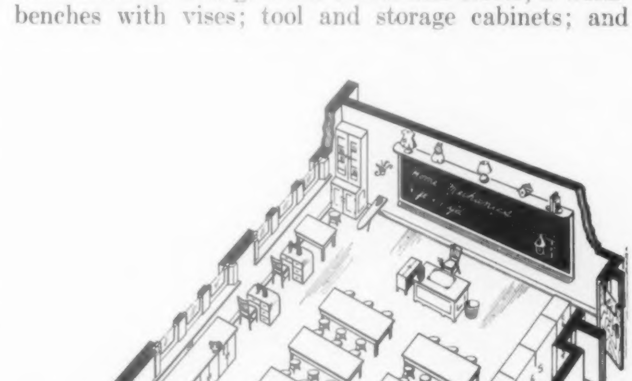


Fig. 1—A fully-equipped Home Mechanics Laboratory, for grades 6, 7, and 8

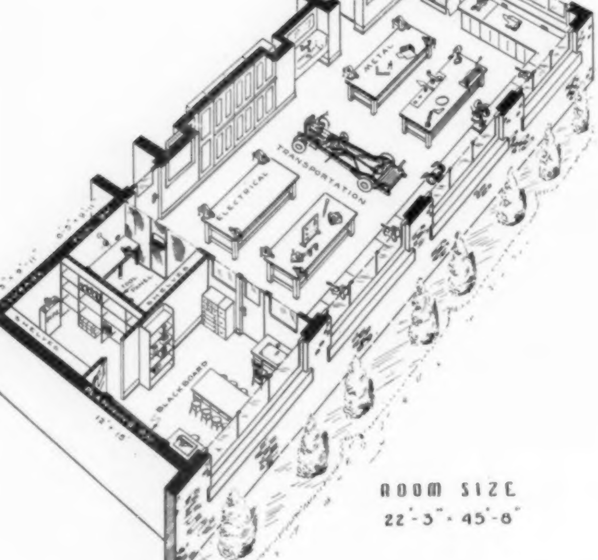


Fig. 2—Industrial Arts Laboratory, showing arrangement of areas of instruction

30 feet of wall bench with storage space below. Two cooking tables with four-burner gas stoves at the side, 2 sewing machines, an ironing board, a teacher's desk, a file cabinet, and wall shelves for displaying finished work complete the equipment installed in the laboratory. (See Fig. 1.) The room is provided with gas and electrical outlets, a sink, and running water. Built-in cupboard space is provided wherever possible.

The use of power machinery is not required in the course. The only machines provided are two sewing machines and a hand-driven tool grinder. A wide variety of construction materials is provided and includes those typical of the various instructional areas of the home mechanics laboratory.

The Industrial Arts Laboratory.—The Industrial Arts Laboratory is a practical course which interprets to 9th-grade boys the modern trade and industrial world. It takes a place along with other subjects in contributing to the general education of the boy, although it is a relatively new educational offering in Chicago. In 1936 a committee was appointed by the superintendent of schools to survey the needs of 9th-grade boys in the field of industrial education. This committee—composed of principals, shop teachers, and the director of industrial arts—formulated the guiding philosophy of the new course. A complete graphic analysis was made of the organization plan, together with a classification of the learning experiences for each instructional unit.

The content of the course has been drawn from eight broad and inclusive areas of industry. These areas, in which every person has daily experiences, are as follows:

Planning—comprises mechanical drawing, sketching, map making, reproduction of drawings, and a study of home plans.

Housing — embodies building construction along with the making of a variety of woodworking projects.

Metals—includes mining, refining, and manufacturing methods in the field of metals, manipulation of metals, and the use of machinery in the construction of projects in common metals such as steel, copper, brass, and aluminum.

Electricity — involves the fields of magnetism, power, light, heat, and communication.

Graphic Arts—provides for practice in setting type, printing, linoleum block carving, illustrating, and bookmaking, together with a study of such forms of reproduction as the silk-screen process, photography, and lithography.

Ceramics—includes making articles of clay, cement, plaster, glass, and plastics, and a study of these materials in industry.

Transportation—embraces an analysis of existing methods of transit by land, air, and water vehicles.

Textiles—consists of the evaluation and testing of fabrics, and the production of handiwork, using string, yarn, and cloth.

Being a flexible course, new materials are readily added to the content of the industrial arts laboratory. As an example, plastics, a rapidly growing field, was recently added. Work in alabaster is another example of additional material inserted into the course of study. (See Fig. 2.)

The Laboratory of Arts and Industries.—The Laboratory of Arts and Industries is a new shop and drawing course designed to fit the educational needs of boys in the 10th and 11th years of the general high

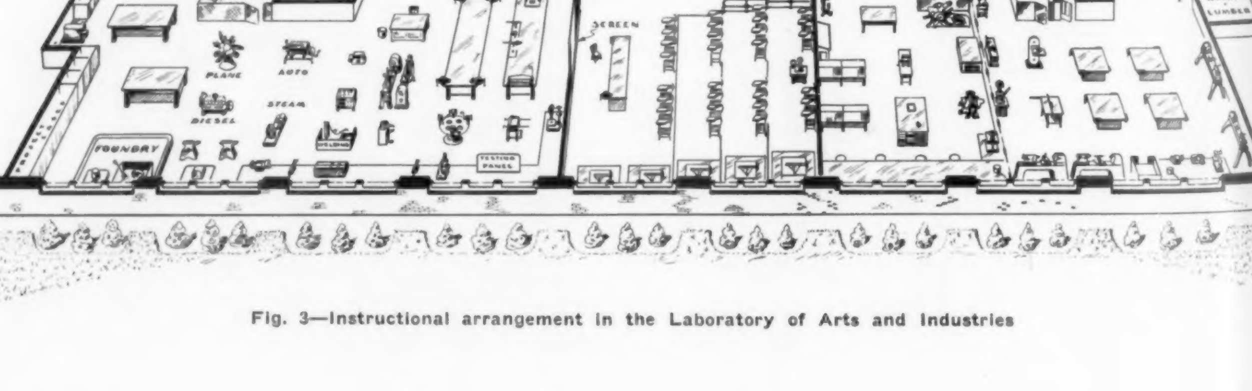


Fig. 3—Instructional arrangement in the Laboratory of Arts and Industries

Chicago's Industrial Arts Laboratories Go to War

Below—Inspecting stretcher frames for the Red Cross

Incidents in the making of scale model planes for the Navy, from top to bottom: inspection by Dr. William H. Johnson, superintendent of schools; the check-up before shipment; girls are interested, too

Chicago's Industrial Arts Laboratories Go to War

Preparing games for the USO, from top to bottom: inspecting finished games; making boards and checkers; using the silk-screen process to put the background on

Below—Learning how to make home appliances last

school. It is intended for those who wish to take additional training in the industrial field as a part of their general education, but who do not desire a strictly technical or vocational course. The first laboratory was installed in September, 1940. Plans for the second are now in progress.

The equipment and curriculum of the laboratory have been organized to further the students' interests and understanding of the materials, processes, and effects of modern industry on our social-economic life. Another aim of the course is to offer each student an opportunity to follow his special industrial interests and to learn advanced operations and skills typical of modern practice in a trade or industry. The student may specialize to a much greater extent in the arts and industries classes than in the first-year industrial arts class. (See Fig. 3.)

For plastics and woodworking the laboratory contains a well-equipped toolroom, 4 large woodworking benches accommodating 16 students, and several of the newest type of wood-turning lathes for patternmaking, cabinetmaking, or plastics. A circular saw, bandsaw, and a scroll saw are provided. An electric sanding machine, tool grinder, drill-press jointer, and a small metal-turning lathe are part of the equipment. The plastics molding press, heated by electricity, is used to make articles from ground or granular plastic material.

The graphic arts room is equipped with modern tools and machines for type composition, presswork, linoleum illustration, silk-screen printing, bookbinding, and photography. Modern metal type stands are in well-lighted positions. An imposing table and a proof press for the typesetters, a power-driven platen press, a paper cabinet, and a large paper-cutter have been installed. A wire-stitching machine for binding pamphlets is also supplied. A work-table provides a suitable place for producing silk-screen illustrations.

The planning section, adjacent to the graphic arts room, is equipped with tablet armchairs. The floor is terraced to give each student a clear view of all that is being done on the demonstration table. Along one side of the room are 5 mechanical drawing benches upon which students may plan their projects. A movie projector and screen are provided, together with black shades for the windows.

The third room, a large one, houses the metals, transportation, power, communication, and electricity areas. There are two large metal-working tables, one wired with electricity for testing apparatus, the other supporting a bar folder and arbor press. A floor-type drill press, a squaring shear, a revolving forming machine, and a panel for testing electrical devices have been installed. A furnace to heat soldering coppers, a metal-cutting scroll saw, and electroplating material complete the equipment. In the central section are two automobile motors, a motor analyzer, a one-cylinder Diesel engine, and a steam engine and turbine. A gas welding set and an electric spot welder are provided. A power hacksaw, a metal-turning lathe, and a metal-spinning lathe are also provided.

For safety the molding area has been equipped with a concrete floor and curb. A molding bin and a gas-fired melting furnace have been installed so that iron, brass, copper, and other metals may be melted and poured. A heat-treating furnace is included.

Since February 1, 1942, the Industrial Arts Laboratories and Laboratories of Arts and Industries have been used part of the time for the training of 8,000 boys in the War Department's new pre-induction course in fundamentals of shopwork. Up to this time Chicago's industrial arts laboratories have proved well adapted to the type of war activity that the age range of the boys and girls permits.

Six Wartime Functions of Industrial Arts Shops and Laboratories in Teachers Colleges

By S. L. COOVER

Director of Industrial Arts Teacher Education, State Teachers College, California, Penna.

IT has been said that soldiers who cannot read blueprints and use tools effectively in World War II are as illiterate as those soldiers who could not read or write at the time of World War I. Certainly a mechanized war needs mechanics on the battlefield as well as in the factories. The fact that the ordinary soldier of this war must be able to assemble and disassemble such complicated mechanisms as machine guns, trench mortars, and the like while in total darkness attests to the fact that the margin between life and death frequently depends more upon mechanical literacy than upon any other single factor. The new element in this war, one which will in the end tip the balance toward victory, is the degree of mechanical proficiency exhibited by every front-line fighter.

It is to be emphasized, then, that any teachers college with adequate shop and laboratory facilities has six distinct functions to perform in helping to produce mechanically literate soldiers and workers.

1. Training Teachers in Technical Subjects and Skills.—The first and perhaps the most important function of a teachers college is to train a maximum number of teachers, both men and women, in many aspects of shop work as well as in the physical sciences and mathematics.

The basic shops for war production workers as well as for soldiers and sailors are machine, airplane mechanics, airplane sheet metal, foundry, wood (including model and glider building), and electricity (including electronics and code practice as well as the regular motor, generator, and electrical maintenance work). Very closely allied to this work in shops are

blueprint reading, mechanical drawing, engineering drawing, and airplane sheet-metal drafting.

Young men and women who are graduated from an industrial arts curriculum with this type of training are in a good position to help the war effort most by teaching others, both in and out of the armed services, the basic and primary skills necessary for war production. These skills are equally necessary for combat service in the type of mechanized war we are now waging.

That the Army and Navy needs men with this type of training is shown by the fact that 50% of our industrial arts graduates of the last ten years are now commissioned officers. Quite a number of these have charge of service technical schools. Many other graduates of recent years have qualified as civil service teachers at Chanute Field, Rantoul, Ill.

*2. **Building Model Airplanes.***—The production of wooden airplane models for the government has been an interesting job for us as well as for thousands of secondary schools and colleges throughout the country. Few things have been accomplished in industrial shops that enlist the same amount of interest, enthusiasm, and hard work. This project alone has given

Above—Exterior view of the industrial arts building, State Teachers College, California, Penna. The building cost $200,000 and was completed February 1, 1939. It was planned to accommodate from 350 to 400 students. The main part of the building is two and a half stories high, 176 by 67 ft. Two one-story wings, 51 by 67 ft., provide a total of more than 38,000 sq. ft. of floor space. The floor plans of this building are reproduced below and on the next page

Right—Electric wall outlets are placed at 4-ft. intervals around the shops and demonstration rooms. Special service lines—water, gas, electric, and compressed air—were installed in all shops and storage rooms and will facilitate changes. Large-size lockers, 18 by 18 by 72 in., built in along the corridors of all floors, provide storage space for partially completed work

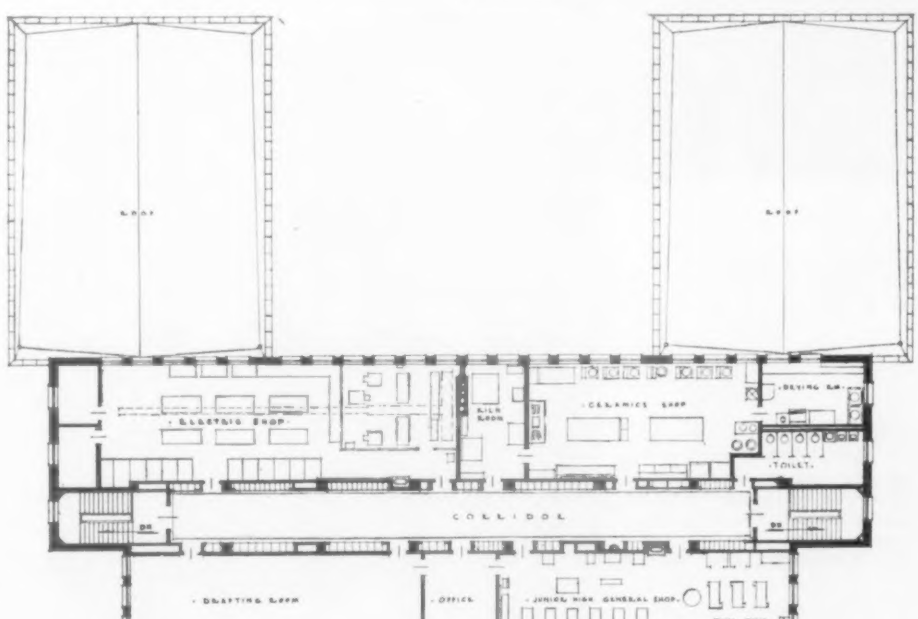
· BASEMENT FLOOR PLAN ·

Left—The reference and planning room are accessible to outsiders as well as to those regularly using the building. Conveniently adjacent to the graphic arts room are a design and editorial room for planning and research, a completely equipped photo-engraving room, and a large stockroom for the storage of paper and other materials. Lockers, 18 by 18 by 18 in. open into the machine shop

· FIRST FLOOR PLAN ·

thousands of adolescent boys and girls a chance to work directly toward helping to win the war.

3. Training War Workers for Mechanical and Technical Occupations.—Teachers colleges such as ours, with modern and adequate equipment, have another important wartime function to perform. That is to make their facilities available for the direct training of machine operators, machinists, welders, draftsmen,



Right—The drafting room, office for conferences, and ceramics laboratory supplement the room set aside for demonstration work. Unnecessary duplication of equipment has been avoided

· SECOND FLOOR PLAN ·

Left—One end of the machine shop in the industrial arts building of the State Teachers College at California, Penna. Students are busy on the production of 6 in. tool grinders. A completed grinder and parts for other grinders are shown on the bench in the foreground

Below — A corner of the foundry. Trainee is working on a mold for a 6-in. grinder. A recently poured casting is at the molder's right

Above—Milling machine. A vulcanizing mold for splicing a mine cable is being milled

Right—Electrical laboratory. The college has given training in all phases of electricity, including electronics and code practice as well as the regular motor, generator, and electrical maintenance work

and so forth, for industrial wartime jobs. This type of work can be most expediently carried on during the two shifts, 4 P.M. until midnight and from midnight until 8:00 A.M., when the shops are not occupied by the regular college students.

For example, we are training machinists, machine operators, and welders in the Vocational Education for National Defense Program. During the past year we have trained and placed in wartime industries in our immediate vicinity 175 machinists and machine operators and an equal number of electric welders.

In addition to the training received by these workers, there are two very important by-products in the Vocational Education for National Defense Program. In Pennsylvania as well as in many other states we have a War Production Training Tool Program in which the trainees work on actual small-tool production rather than on practice exercises. Machine fixtures, as well as every imaginable type of hand and bench tool, are made. This enables the Department of Public Instruction to supply all school shops in the state with tools which are otherwise not available.

A second by-product of training in our shop is the production of repair parts for a local coal mine. Included in this production are armature shafts for 20-ton mine locomotives, as well as a hundred other varieties of machine and welding work required by this industry. We are frequently called upon to help with special jobs by local war industries. For example, we have made several hundred rubber vulcanizing molds since the war began—making the patterns, pouring the castings, and machining them. Each mold is a special job and cannot be otherwise obtained at the present time.

This is suggestive of the type of arrangement that can frequently be made between industry and schools where all materials, including cutters, welding rods, and special jigs and fixtures are supplied by the industry; while the school profits by working on a much larger and more practical type of work than would otherwise be possible. This type of cooperation is very effective in reducing instructional costs.

4. Cooperating Directly With the Army and Navy.—A teachers college may cooperate directly with the War Department in offering its facilities, including its faculty members, for the training of Army and Navy personnel in machine-shop, airplane sheet-metal, radio repair, and other such courses.

On April 8, 1942, a group of 60 radio repair trainees was sent to our college for instruction in all phases of radio repair, and for instruction in the basic electrical and electronics theory necessary for a thorough understanding of radio work. The women were civil service employees of the United States Army Signal Corps, while the men were enlisted reservists. Two hundred and forty persons have been trained in the inspection, operation, maintenance, and repair of radio signalling equipment and radio testing equipment up to the present time. This war training was carried on in our physical science department, where we also have a radio transmitter for code practice.

5. Training Airplane Pilots.—The training of airplane pilots was begun in January 1940, long before we became entangled in the war. In cooperation with the Civil Aeronautics Authority we have given ground and flight training to over 100 young men and women. The great majority of the men who received their private pilot's licenses here have gone to advanced Army and Navy training schools.

6. Training Workers in Civilian Defense.—All employees are actively serving in civilian defense groups. Courses in first aid, home nursing, auxiliary police work, air-raid warden training, messenger work, and gas and fire fighting were organized, and thousands of civilian defense workers have been trained. Special schools for instructors were set up and the entire country supplied with trained instructors. The college itself organized its defense council and has operated this as a model for the benefit and training of the student body.

Adapting Wood and Metal Shop Facilities to Air-Age Education

By GORDON O. WILBER

Director, Division of Industrial Arts Teacher Education, State Teachers College, Oswego, N. Y.

THE unusual and critical requirements of a world at war are making far-reaching adjustments necessary in all areas of American education. Important among such changes are those concerned with meeting the needs of an education for a new era—the air age. Oswego State Teachers College has, for the past year, been making fundamental changes in curriculum, methods, and shop organization in recognition of this trend.

The School and the Problem

Oswego State Teachers College is one of eleven institutions engaged in the preparation of teachers for New York State. The schools at Oswego and Buffalo are the only state-supported colleges where preparation is offered for industrial arts teachers. Each school, under normal circumstances, graduates about 40 men for this field each year.

A new industrial arts building was dedicated at Oswego in 1933 to provide facilities for this work. Shops and classrooms are provided for all of the types of activities usually comprehended within the meaning of the term. (See Figs. 1, 2, and 3.) These include separate rooms for woodworking (see Fig. 4), millroom practice, metal work (see Fig. 5), auto mechanics, printing, electricity, and comprehensive general

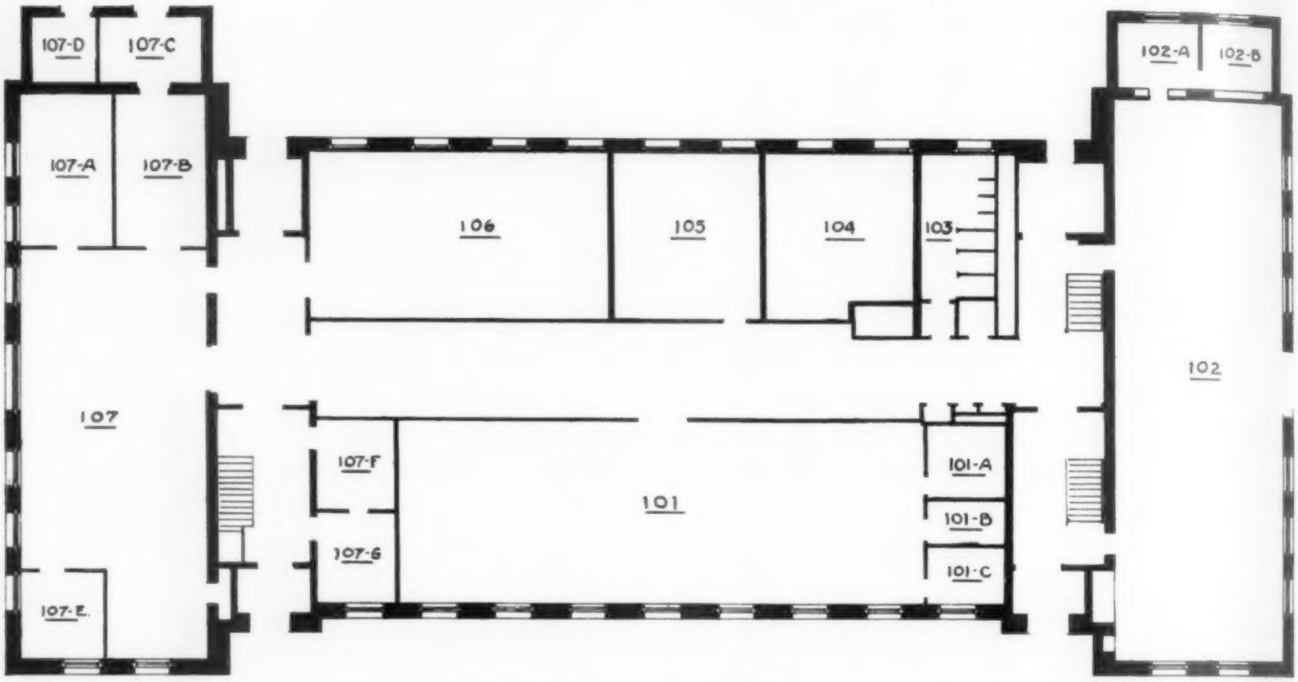


Fig. 1. First Floor, Industrial Arts Building, Oswego State Teachers College

LEGEND

101. General Metal, 71 x 25 ft.
101A. Stockroom, 10 x 10 ft.
101B. Tool Room, 6 x 10 ft.
101C. Office, 8 x 10 ft.
102. Auto Mechanics, 27 x 84 ft., with mezzanine, 9 x 84 ft.
102A and 102B. Supply Rooms, each 12 x 12 ft.
103. Lavatory, 12 x 19 ft.
104. Boiler
105. Classroom, 20 x 25 ft.
106. Mill Room, 25 x 40 ft.
107. Bench Room, 25 x 6 ft.
107A. Finishing Room, 13 x 18 ft.
107B. Lumber Storage, 12 x 18 ft.
107C. Storage, 8 x 10 ft.
107D. Fan Room, 8 x 8 ft.
107E. Tool Fitting Room

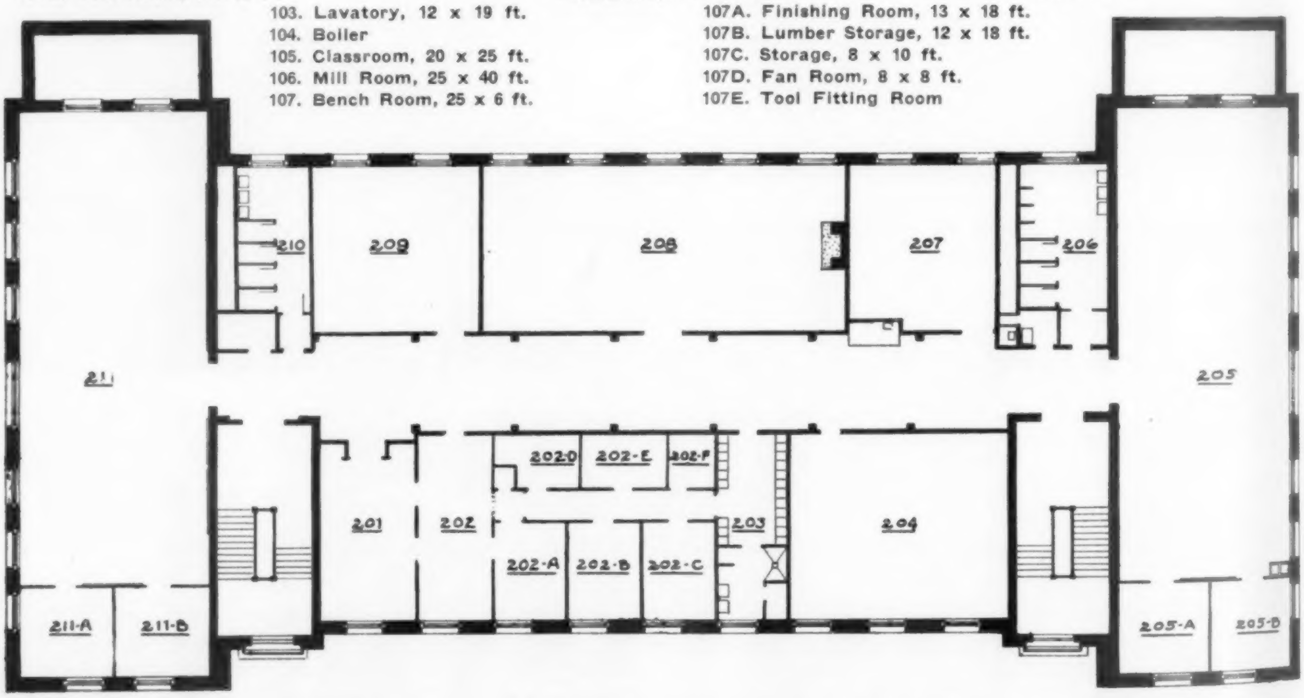


Fig. 2. Second Floor, Industrial Arts Building, Oswego State Teachers College

LEGEND

201. Director's Office, 13 x 25 ft.
202. Secretary's Office, 10 x 25 ft.
202A. Office Supervisor Practice Teaching, 10 x 13 ft.
202B and 202C. Offices, each 10 x 12 ft.
202D, 202E, and 202F. Storage
203. Faculty Locker Room and Lavatory, 10 x 22 ft.
204. Classroom, 25 x 30 ft.
205. Printing and Publishing, 26 x 64 ft.
205A. Stockroom, 12 x 12 ft.
205B. Office, 12 x 12 ft.
206. Lavatory, 12 x 19 ft.
207. Classroom, 20 x 20 ft.
208. Library, 22 x 50 ft.
209. Classroom, 22 x 22 ft.
210. Women's Lavatory, 12 x 19 ft.
211. General Shop, 26 x 64 ft.
211A. Office, 12 x 12 ft.
211B. Supplies, 12 x 13 ft.

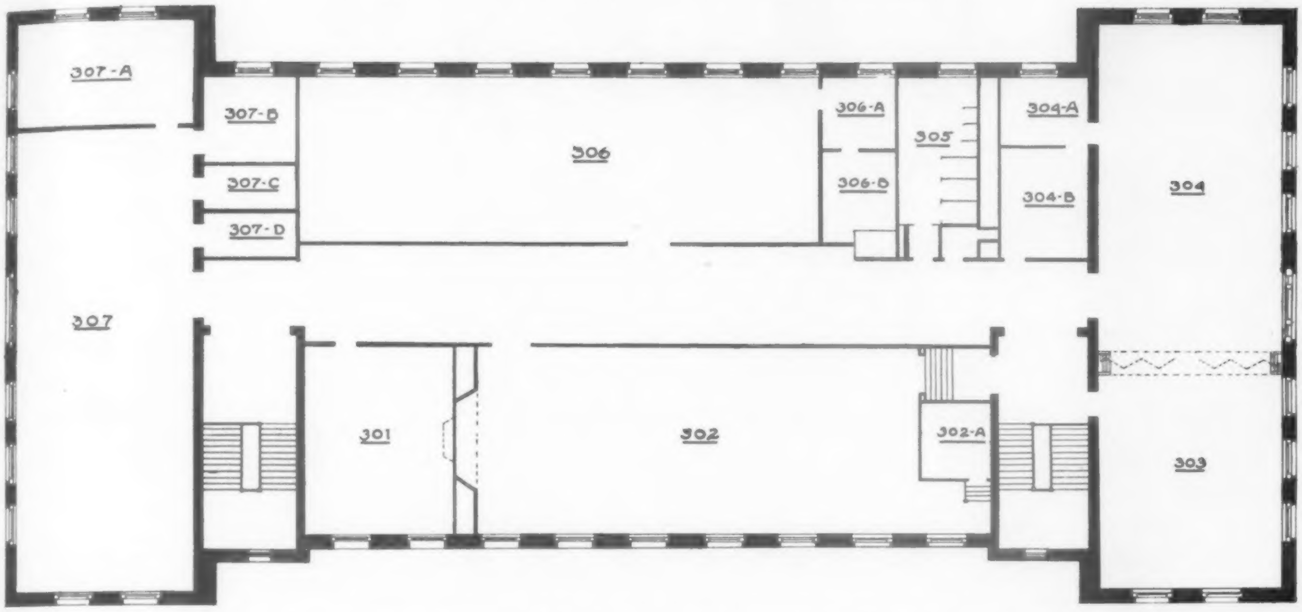


Fig. 3. Third Floor, Industrial Arts Building, Oswego State Teachers College

LEGEND

301. Classroom, 20 x 25 ft.
302. Lecture Room, 25 x 63 ft.
302A. Projection Booth, 9 x 10 ft.
303. Design, 25 x 28 ft.
304. Drafting, 25 x 48 ft.
304A. Office, 9 x 12 ft.
304B. Blueprint Room, 12 x 15 ft.
305. Lavatory, 10 x 19 ft.
306. Science Laboratory, 22 x 70 ft.
306A. Office, 9 x 10 ft.
306B. Supplies, 9 x 10 ft.
307. Electric Shop, 25 x 62 ft.
307A. Radio Room, 14 x 25 ft.
307B. Office, 11 x 12 ft.
307C. Tool Room, 6 x 12 ft.
307D. Stockroom, 6 x 12 ft.

shop. Rooms are also equipped for drawing, photography, and science. There are also numerous standard classrooms.

When it became evident that aeronautics must play an increasingly important part in future education, we faced the problem of adapting our present facilities to meet this new challenge. Decisions were necessary concerning not only physical equipment, but also staff preparation. Until the fall of 1941, no instructor had been provided to teach the work in auto mechanics, for which a shop had been provided. (See Fig. 6.) At that time an instructor was engaged who was qualified to teach both auto mechanics and aeronautics, as well as other areas within this general field, with the idea of expanding this work to include the whole field of transportation. By January of 1942, however, world events had focused attention so fully upon the need for education for an air age that the course was changed to place full emphasis upon aeronautics. It was impossible by this time to secure any considerable equipment, but students and instructor worked together to build and improvise most of the essential items. Room was provided for the construction of a 4-ft. wind tunnel by storing or disposing of some of the auto mechanics equipment. When completed, this device will provide a means for testing and instruction equal to that found in most engineering colleges. Many other teaching devices were developed, among which were lift-and-drag indicators, Venturi tube demonstrators, propeller pitch demonstrators, and control demonstrators. Working models of various flying and engine instruments were also constructed.

As a result of this work, about thirty seniors were prepared to teach aeronautics in the schools of New York State. Unfortunately, most of these men were called into the armed services before having the opportunity to show the full value of their training. Thus, at the end of the school year in 1942, the school was faced with the problem of deciding upon the next steps in providing training for this air age.

Adapting the Metal Shop Course

The decision was reached that every subject should be utilized to provide the maximum possible emphasis on this field. New and pertinent material was introduced into science, mathematics, social studies, English, and all the other subjects. The metal-working course appeared, however, to hold unusual opportunities for achieving the desired ends.

Metal work, in the past, had consisted of a series of experiences designed to acquaint the student with a few basic processes in sheet-metal work, art-metal work, foundry practice, forging, welding, bench-metal work, and machine-shop practice. The problem thus became one of finding a suitable project which would give basic training in as many as possible of these areas, and at the same time contribute to the general "air conditioning" of the student. Many had constructed various types of gasoline-run model planes during their course in aeronautics. Naturally, a power plant was needed for each; and many students could not raise the cash necessary to purchase a commercial model. Consequently, it was decided to design and build these miniature engines as a part of the metal course.

Working Out the Project.—The woodworking instructor had a rich background of experience in the design and building of engines for model boat racing. He willingly undertook the task of directing the de-

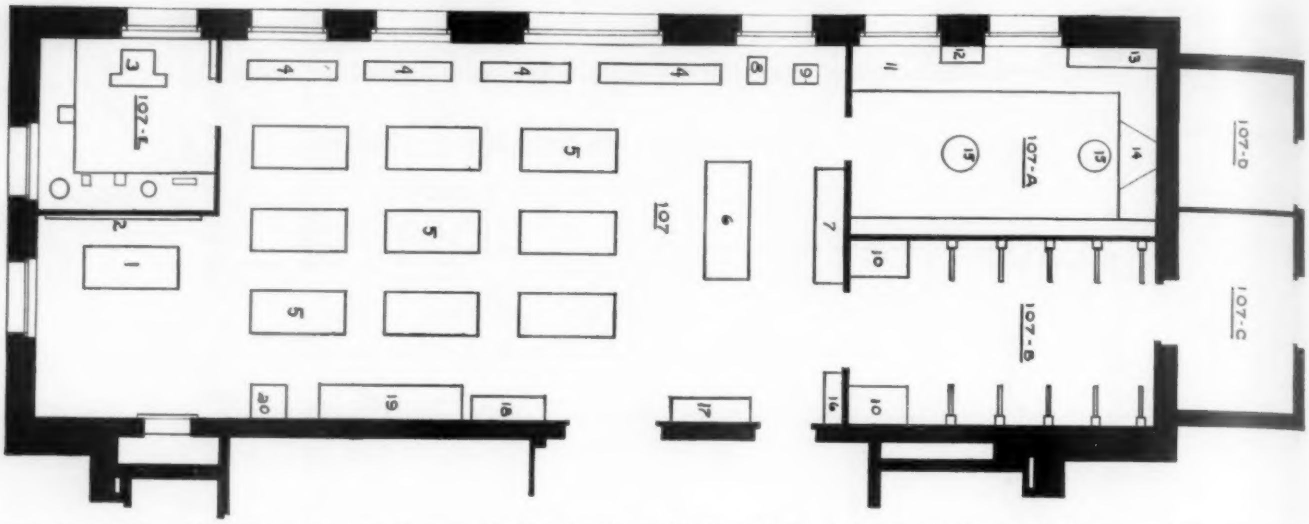


Fig. 4. Woodworking Shop. Legend: 1. demonstration bench, 2. blackboard, 3. grinder, 4. woodturning lathe, 5. woodworking bench, 6. assembly bench, 7. glue table, 8. trimmer, 9. jig saw, 10. shorts bins, 11. stair bench, 12. univent, 13. wall cabinets, 14. spray exhaust booth, 15. turn tables, 16. clamp rack, 17. display case, 18. sink, 19. tool board and cabinet, 20. tool grinder

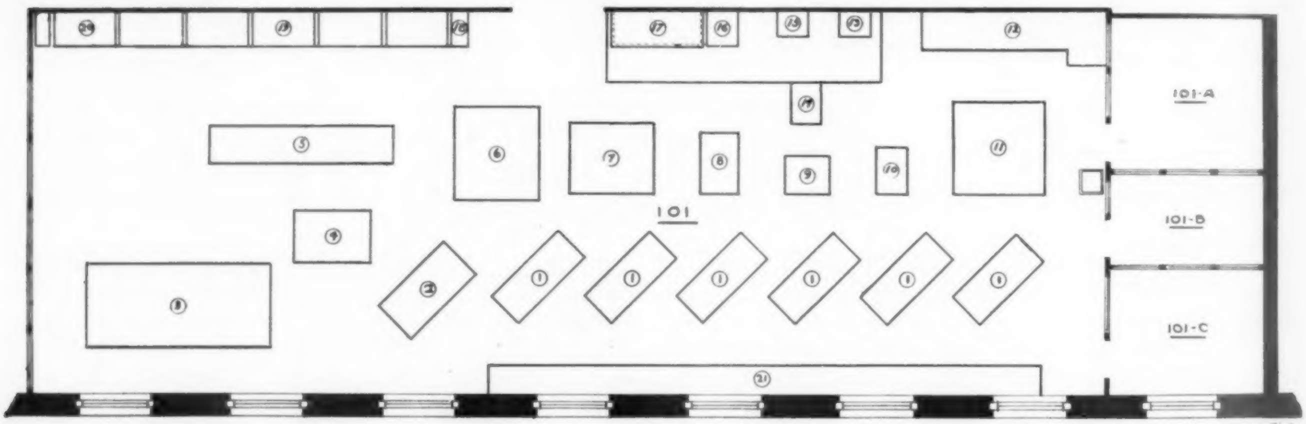


Fig. 5. Metalworking Shop. Legend: 1. engine lathes, 2. spinning lathe, 3. sheet metal bench, 4. sheet metal machines, 5. sheet metal bench, 6. milling machine, 7. sharper, 8. wet grinder, 9. power hack saw, 10. drill press, 11. precision grinder, 12. molding unit, 13. crucible furnace, 14. anvils, 15. gas forge, 16. vise, 17. sink, 18. bench drill press, 19. metal bench, 20. buffer, 21. wall bench

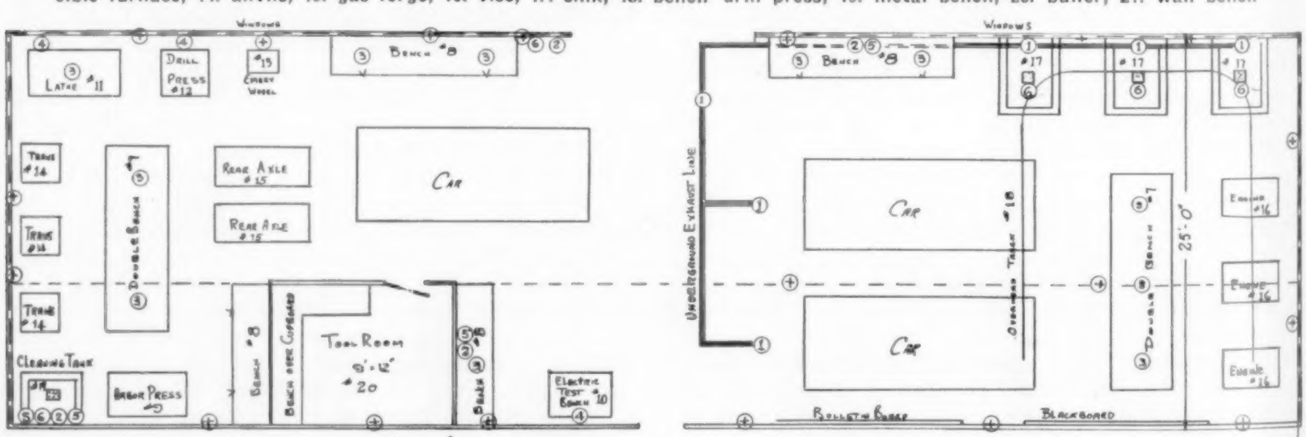


Fig. 6. Transportation (including Auto Mechanics). Legend: 1. exhaust outlets, 2. compressed air outlets, 3. vises, 4. special electrical outlets, 5. greasing equipment, 6. trouble lights, 7. engine repair bench, 10. engine analyzer, 13. grinder, 14. transmissions, 17. benches, 19. welding outfit

Fig. 7. Preparing the mold for a model airplane engine

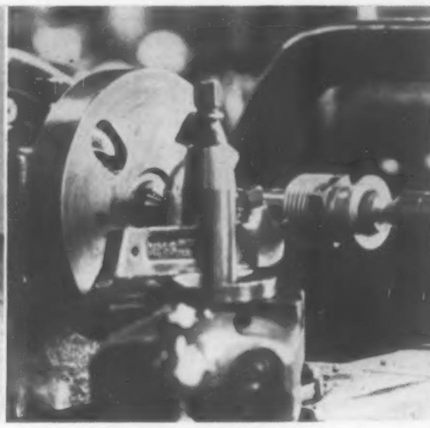


Fig. 8. Machining the cylinder for a model engine

Fig. 9. The completed engine for a model plane

signing problem. He also worked out patterns and core boxes for the necessary castings.

Students and instructor have worked together, during the past semester, to perfect the processes involved in the making of these engines. Demonstrations covering the basic operations are provided and students are given individual help as the need arises. The first job consists of making the necessary cores. These are prepared after the usual manner and baked in a core-oven, made from a small oven such as is used on the top of an oil stove. The molds are then prepared, using fine molding sand. (See Fig. 7.) Great care is exercised to assure sound castings, free from sand holes or other imperfections. Junk aluminum is used for these parts. The castings are then machined to exact size and shape. It has been comparatively easy to impress upon the students the necessity for working to accurate limits on a project of this kind. (See Fig. 8.)

The finished product (see Fig. 9) has proved highly successful in actual operation. While the making of this project has required no extensive readjustments in the physical shop plan (see Fig. 5), it has required much planning and many changes in curriculum offerings. Student reactions and the instructor's observations seem to indicate that this activity is making a real contribution to the "air-conditioning" program.

Glider Construction

The possibility of adding glider construction to the offering at Oswego was considered early in the spring semester of 1942. It was becoming increasingly clear that gliders were to play an important part in the scheme for getting American youth into the air. Accordingly, plans for the Baby Grunau II (a German-designed craft) were secured with the intention of immediate construction. The necessity, however, for concentrating all effort to produce a quota of identification models for the U. S. Navy made necessary a postponement; but the idea of building a glider was not given up.

During the summer vacation, the opportunity to attend a glider construction course, given at Cornell University, under the sponsorship of the State Education Department, was offered to a member of the Oswego staff. The experience gained by the woodshop instructor, who accepted the invitation, undoubtedly added much to any success which may be achieved through this offering.

Because a glider such as the one selected is made largely of wood, it was decided to utilize the facilities of the woodworking shop (see Fig. 4) for this course. The instruction was divided between the woodworking and aeronautics instructors. This was done not only to assure adequate individual instruction, but also to make sure that the work carried the essential related content in such areas as aerodynamics, navigation, and meteorology.

The course has been highly successful, from the standpoint both of work accomplished and of student interest. Students who were only mediocre craftsmen in their elementary shops have produced parts for the glider which involve the most precise workmanship.

The results of the course, however, extend far beyond mere tool techniques. As a first step, it was necessary to make full-sized drawings of all parts for the craft. Improvised boards were made from plywood and covered with large pieces of wrapping paper. Each student was assigned to a specific part, such as a bulkhead or a wing rib. From the data given on the blueprints, they then proceeded to make an accurate full-sized drawing. Inasmuch as the craft was designed and drawn in Germany, all of the measurements were given according to the metric system. It was necessary, therefore, not only for the students to be able to read the drawings, but also to be thoroughly competent in the use of the meter stick and centimeter rule. The need for absolute accuracy in the matter of both drawing and construction also became apparent, inasmuch as the part made by any given individual had to fit perfectly with those made by others. That such ability was developed is made evident by the fact that three of the students from this course were requisitioned by a commercial firm, which was doing experimental work on a new plywood-covered airplane, to draft several of their more intricate parts. That they were able to do this work successfully (see Fig. 10) is a tribute to the experience they gained from the course.

Solving Problems of Construction and Equipment. —As the work developed, the need for special jigs and devices became evident. One of the first problems concerned finding a method for gluing the bulkheads in such a manner that every one of the dozen or more

Fig. 10. Students lofting parts for a commercial airplane

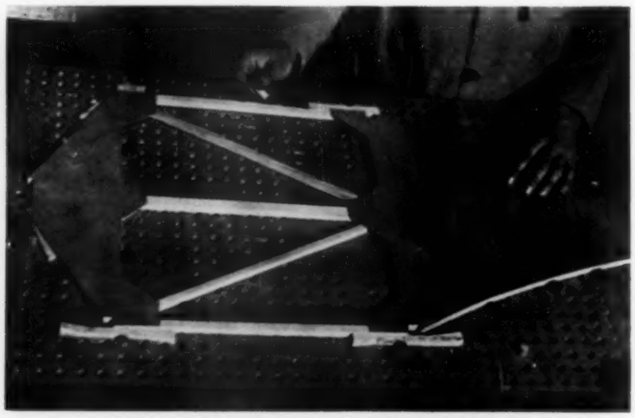


Fig. 11. Jig for gluing glider bulkheads

joints would be held firmly in place until the glue had a chance to "set." Fig. 11 shows the solution as worked out by students and instructors. One-half-inch holes were drilled in a piece of $\frac{3}{4}$-in. plywood on $1\frac{1}{4}$-in. centers. Using straight and eccentric plugs in conjunction with small wooden wedges, it was possible to bring just the right amount of pressure on each joint. Similar jigs were made for smaller parts.

Actual assembly of the glider started with the completion of the bulkheads. A plank was shaped to conform to the bottom of the glider. The bottom strip was fitted on this and the position for each bulkhead clearly marked. Bulkheads were then placed and the supporting longerons fastened. (See Fig. 12.) As other parts, such as the elevators, rudder (see Fig. 13), and wings are finished, they will be added to the assembly. The whole surface is then to be covered with plywood and fabric.

It will be evident from the photograph that the construction of a glider calls for many readjustments with regard to the physical placement of equipment. Large assembly space is needed, and the movement and re-grouping of benches and other pieces of equipment becomes essential. The matter of assembly space was solved in this case by utilizing part of an unused corridor between the woodshop and the mill-room, on the first floor of the industrial arts building. Besides giving ample space, the fact that the glider was in plain view of all who entered the building helped to advertise the progress of the course to students and visitors.

Other adjustments will be required as the work progresses. The assembly of the wings (which requires an unusually large amount of space) will be accomplished by a complete rearrangement of the equipment in the transportation shop. (See Fig. 6.) The final assembly of the craft will also be made in this room.

All Departments Are Making Adjustments

The fact that considerable stress has been placed upon the metal-work and glider construction courses should not be construed to mean that other departments are not being modified to meet war needs. Every shop and class feels the impact of the war, and is making such changes as are necessary to contribute as effectively as possible to its successful conclusion. It is hoped, however, that many other schools may wish to initiate work in the two fields which have been described at length, and that the experiences of Oswego may be helpful.

Fig. 12. Assembling the glider

Fig. 13. Assembling the rudder

AN INVENTORY PLAN FOR SCHOOL SHOP EQUIPMENT

By WILLIAM J. COONEY

Director of Educational Expenditures and Economy, Board of Education, Chicago, Ill.

IN an organization the size of the Chicago public school system it is necessary that equipment be acquired, supplied, and inventoried in an efficient and economical manner. The term *school shop equipment*, as discussed in this article, relates only to machinery and equipment used for instructional purposes, and does not embrace small hand tools or supplies of an expendable nature.

Before inauguration of our present inventory plan a preliminary survey of the Chicago public schools showed we had more than 650 shops (aviation, welding, machine, auto, electric, pattern, woodworking, printing, etc.), located in approximately 50 schools. These shops range from 60 in number for a school, decreasing to 4 or 5 in some of our smaller schools and branches, and represent building costs of $11,000,000 and shop equipment valued at $9,000,000, or a total of $20,000,000.

Mr. Alfred H. Clarke, Director of Educational Expenditures and Economy at the time this survey was made, took over the responsibility for the creation and development of our present inventory system. Under his supervision all shops were inventoried, all equipment classified, a filing system for catalogs established, and a method of processing specifications devised which makes the selection of equipment an easy procedure.

Inventory Books—School Shop Equipment

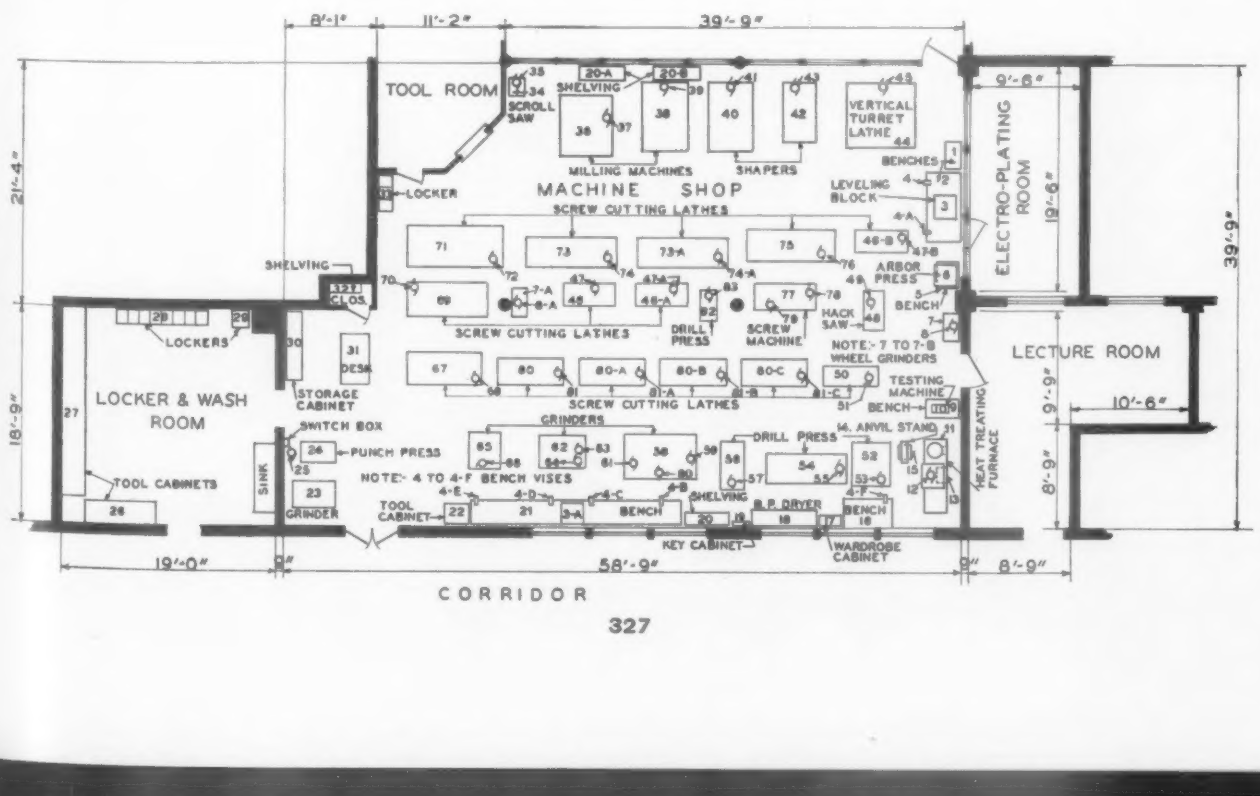
As a result of the survey some 650 Inventory of School Equipment books were compiled. Each book contains a layout and description of the equipment in a designated shop, as well as the commodity number, blueprint number, make, size, condition, location, and

Doc. No. 81-103-5101 Sheet 8 of 12 Dec.23,1942

QTY.	B.P.	COM. NO.	EQUIPMENT
1	48	8728-C1B	SAW, HACK, POWER- Wet Cut, 6"x6" Vise Capacity, Stationary, Floor-Model, Rear Belted Motor Drive. Serial No. 2755. MAKE- Peerless. Good. Floor Space 22"x
1	49	8525-B	MOTOR for above- 1-1/2 H.P., 1125 R.P.M., 220/440 Volts, 60-Cycles, A-c., Three-Phase. Serial No. 401205-A-130. Type B-224.3, Frame 224. MAKE- Oak Electric Co. Good.
1	50	8461-A2	LATHE, SCREW CUTTING- 11" Swing, 48" Bed, Quick Change Gear Box, Cone Pulley Drive to Spindle, Stationary Floor-Model, Overhead Belted Motor Drive. Serial No. 46433. MAKE- South Bend. Good. Floor Space- 58"x 22". Height 60".
1	51	8525-B	MOTOR for above- 1/2 H.P., 1140 R.P.M., 220 Volts, 60-Cycles, A-c., Three-Phase. Serial No. 7306809. Type C.S., Frame 72C. MAKE- Westinghouse. Good.
1	52	8175	DRILL PRESS- 18" Capacity (twice the distance from center of spindle to column), 1/2" Drilling Capacity, 2 Spindles, Stationary, Floor-Model, Overhead Belted Motor Drive. MAKE- Cincinnati Tool Co.,Good. Floor Space- 45"x40". Height 76".
1	53	8525-B	MOTOR for above- 3 H.P., 1730 R.P.M., 220/440 Volts, 60-Cycles, A-c., Three-Phase. Serial No. 5K225A10. Type K, Frame 225. MAKE- General Electric Co. Good.
1	54	8179	DRILL PRESS-RADIAL- 64" Capacity (twice the distance from center of spindle to column), 2" Drilling Capacity, Stationary, Floor-Model, Rear Belted Motor Drive. MAKE- Mueller Machine Tool Co., Good. Floor Space- 84"x31". Height 90"

Above—This sheet from an Inventory of School Equipment Book illustrates the details entered for every piece of shop equipment.

Below—A shop layout plan from an Inventory of School Equipment Book



Vises, Combination, Pipe, Anvil and Machinists' Bench, Stationary Base .... Machine
8949 Vises, Machinists' Bench

Vises, Combination, Pipe, Anvil and Machinists' Bench, Swivel Base .... Machine
8949 Vises, Machinists' Bench

Vises, Combination, Pipe and Machinists' Bench, Stationary Base .... Machine
8949 Vises, Machinists' Bench

Vises, Combination, Pipe and Machinists' Bench, Swivel Base .... Machine
8949 Vises, Machinists' Bench

Vises, Comparator .... Machine
8944 Vises, Chucking

8947 Vises, Compensating Jaw .... Machine

Vises, Drill Press .... Aero, Auto, Electric, I. A.
8944 Vises, Chucking Machine, Wood

8948 Vises, Filers' .... Machine

Vises, Grinding Machine .... Machine
8944 Vises, Chucking

Vises, Leg .... Forge
8941 Vises, Blacksmiths' (Steel Legs)

8949 Vises, Machinists' Bench .... Machine

8949-A1A Combination, Pipe and Machinists' Bench, Stationary Base, 3½"x⅛"x2" Pipe Capacity
8949-A1B Combination, Pipe and Machinists' Bench, Stationary Base, 3½"x⅛"x2" Pipe Capacity
8949-A1C Combination, Pipe and Machinists' Bench, Stationary Base, 4¼"x⅛"x3" Pipe Capacity
8949-A1D Combination, Pipe and Machinists' Bench, Stationary Base, 4½"x⅛"x3½" Pipe Capacity
8949-A1E Combination, Pipe and Machinists' Bench, Stationary Base, 5"x½"x4" Pipe Capacity
8949-A1F Combination, Pipe and Machinists' Bench, Stationary Base, 6"x½"x6" Pipe Capacity
8949-A1G Combination, Pipe and Machinists' Bench, Stationary Base, 6"x⅛"x6" Pipe Capacity
8949-A2A Combination, Pipe and Machinists' Bench, Swivel Base, 3½"x⅛"x2½" Pipe Capacity
8949-A2B Combination, Pipe and Machinists' Bench, Swivel Base, 3¾"x⅛"x2½" Pipe Capacity
8949-A2C Combination, Pipe and Machinists' Bench, Swivel Base, 4½"x⅛"x3½" Pipe Capacity
8949-A2D Combination, Pipe and Machinists' Bench, Swivel Base, 4½"x3½" Pipe Capacity
8949-A2E Combination, Pipe and Machinists' Bench, Swivel Base, 4¾"x⅛"x4" Pipe Capacity
8949-A2F Combination, Pipe and Machinists' Bench, Swivel Base, 5"x4" Pipe Capacity
8949-A2G Combination, Pipe and Machinists' Bench, Swivel Base, 5"x"⅛x4½" Pipe Capacity
8949-A2H Combination, Pipe and Machinists' Bench, Swivel Base, 6"x⅛"x6" Pipe Capacity
8949-B1A Combination, Pipe, Anvil and Machinists' Bench, Stationary Base, 3"x0"x1¼" Pipe Capacity
8949-B2A Combination, Pipe, Anvil and Machinists' Bench, Swivel Base, 3"x0"x1¼" Pipe Capacity
8949-B2B Combination, Pipe, Anvil and Machinists' Bench, Swivel Base, 3"x3¼" Pipe Capacity
8949-B2C Combination, Pipe, Anvil and Machinists' Bench, Swivel Base, 3"x0"x1½" Pipe Capacity
8949-B2D Combination, Pipe, Anvil and Machinists' Bench, Swivel Base, 3½"x0"x1½" Pipe Capacity
8949-B2E Combination, Pipe, Anvil and Machinists' Bench, Swivel Base, 3½"x4½" Pipe Capacity
8949-B2F Combination, Pipe, Anvil and Machinists' Bench, Swivel Base, 4"x0"x2" Pipe Capacity
8949-B2G Combination, Pipe, Anvil and Machinists' Bench, Swivel Base, 4"x5" Pipe Capacity
8949-B2H Combination, Pipe, Anvil and Machinists' Bench, Swivel Base, 4½"x5" Pipe Capacity
8949-B2I Combination, Pipe, Anvil and Machinists' Bench, Swivel Base, 5"x5" Pipe Capacity
8949-B2J Combination, Pipe, Anvil and Machinists' Bench, Swivel Base, 5"x5½" Pipe Capacity
8949-C1A Plain, Stationary Base, 2½"
8949-C1B Plain, Stationary Base, 3"
8949-C1C Plain, Stationary Base, 4"
8949-C1D Plain, Stationary Base, 5"
8949-C1E Plain, Stationary Base, 6"
8949-C1F Plain, Stationary Base, 7"
8949-C1G Plain, Stationary Base, 8"
8949-C2A Plain, Stationary Base, Adjustable Jaw, 2½"
8949-C2B Plain, Stationary Base, Adjustable Jaw, 3"
8949-C2C Plain, Stationary Base, Adjustable Jaw, 4"
8949-C2D Plain, Stationary Base, Adjustable Jaw, 5"
8949-C2E Plain, Stationary Base, Adjustable Jaw, 6"
8949-C2F Plain, Stationary Base, Adjustable Jaw, 7"
8949-C2G Plain, Stationary Base, Adjustable Jaw, 8"
8949-D1A Plain, Swivel Base, 2½"
8949-D1B Plain, Swivel Base, 3"
8949-D1C Plain, Swivel Base, 4"
8949-D1D Plain, Swivel Base, 5"
8949-D1E Plain, Swivel Base, 6"
8949-D1F Plain, Swivel Base, 7"
8949-D1G Plain, Swivel Base, 8"
8949-D2A Plain, Swivel Base, Adjustable Jaw, 2½"
8949-D2B Plain, Swivel Base, Adjustable Jaw, 3"

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Page from a Standardized Shop Commodity Index Book. One standard classification has been adopted for each piece of equipment. Symbols following the basic commodity number indicate variations in construction

floor space occupied by each piece of equipment. Each school is supplied with the books pertaining to its shops. A master set is kept in the Property Control Bureau, and another in the Bureau of Educational Expenditures and Economy. Additions and withdrawals of equipment are posted in the back of the inventory book on extra sheets placed there for that purpose.

The information obtained from these Inventory of School Equipment books assists the Director of Educational Expenditures and Economy in determining:

1. The type of activity which can be carried on in the shops.
2. The need for additional equipment.
3. The possibility of removing excess equipment to shops where it is needed.
4. The replacement of obsolete or worn-out machines.

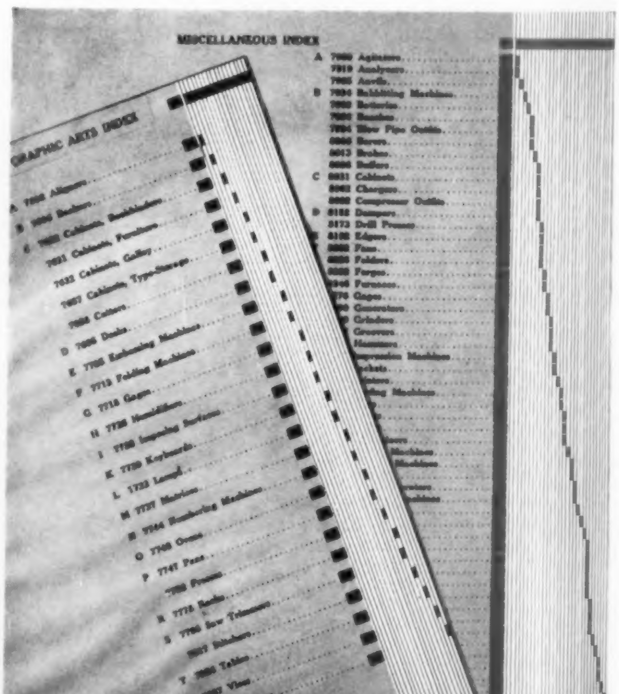
Standardized Shop Index Book

A Standardized Shop Index Commodity Book has been prepared and distributed to every shop teacher in the school system. The book is divided into two parts. One part lists equipment for the graphic arts (composing room, photo engraving room, and press room) and the second includes equipment for all other shops (aviation, welding, machine, auto, electric, pattern, woodworking, etc.). Each list is arranged alphabetically and numerically, and a basic commodity number is shown for each article.

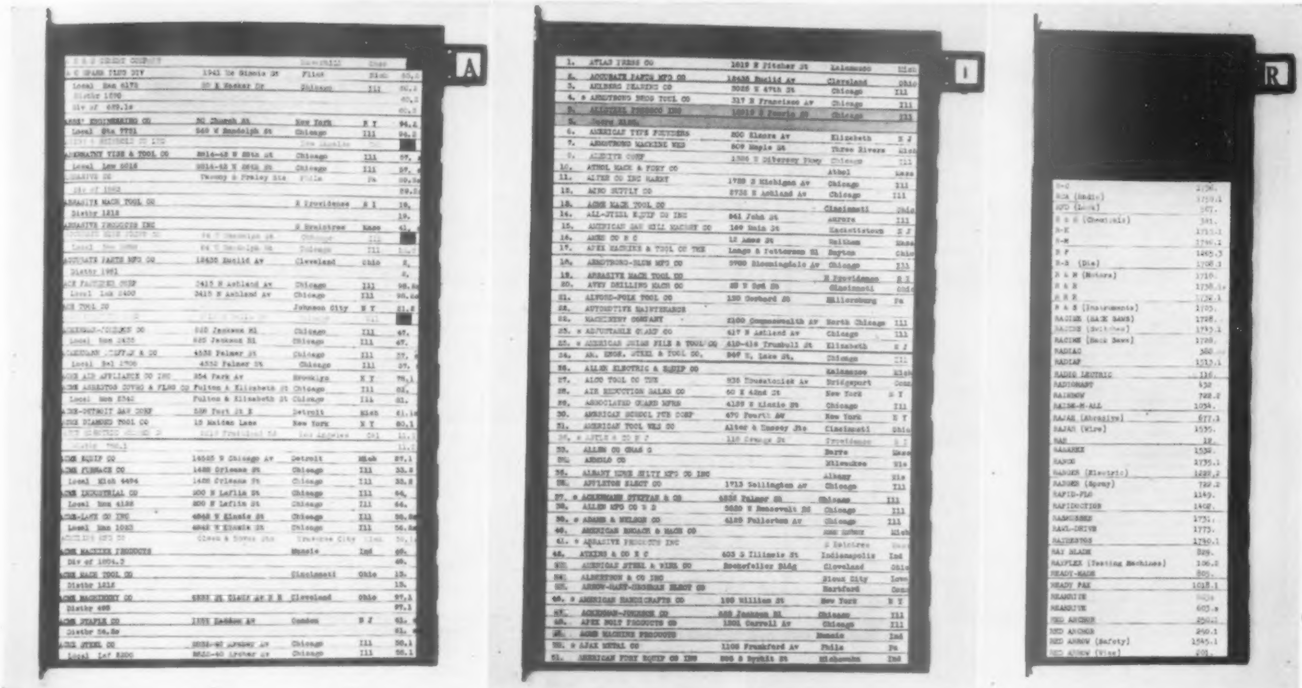
Prior to our present system the graphic arts equipment was listed under commodity numbers 760 to 899 inclusive, and equipment from all other shops was numbered **790 to 899** inclusive. It was found that by arranging these numbers from **7600 to 7899** for graphic arts equipment, and from **7900 to 8999** for equipment of all other shops, sufficient leeway was obtained to give each piece of equipment a commodity number. Equipment items, purchase requisitions, equipment specifications, and Inventory of School Equipment books contain or bear the numbers listed in this commodity index book. In many instances a piece of equipment has been designated in these lists by the various names established by manufacturers, but in all cases only one standard classification has been adopted—all other classifications have been used merely as cross indexes. The standard classifications have such scope, completeness, and conciseness that no matter which name an article may be looked up under, the cross indexing will direct attention to the proper commodity number.

Method of Coding for Budget and Purchase Control

In many cases all of the various sizes and modified forms of construction of an article are indicated by a commodity number followed by a letter, a number, and another letter. The basic commodity number is for property control; for example, **8949** is the control number for "Vises, Machinist's Bench." The letter following the basic commodity number would indicate the first major type of construction. The letter "A" after commodity number **8949** indicates that the vise has a pipe holding feature; the letter "B" would indicate that the vise has a pipe and anvil feature. The number "1" following the letter "A" indicates that the vise has a stationary base. The letter fol-



A multiple spot index, arranged alphabetically, numerically, and according to principal items, as illustrated above, makes it easy to locate articles in the Standardized Shop Commodity Index Book



Manufacturers' catalogs are indexed three ways on revolving visible index files: left, catalogs listed alphabetically by names of manufacturers; center, listing in numerical order—this serves as a check on numbers assigned to catalogs; right, listing by trade name and number

lowing this number indicates the size. No. 8949-A1A Vise would have a size of $3\frac{1}{2}'' \times \frac{1}{8}'' \times 2''$.

Manufacturers' Catalog Library

A complete master catalog system of shop machinery, equipment, and tools is maintained for use in connection with the budgeting and purchasing of such equipment as may be desired from time to time. About 10,000 catalogs, available for instant use, supply complete information on practically all items available on the market. Since manufacturers issue catalogs in a number of sizes, the Board of Education has devised a filing system to take care of this situation. It was found that about ninety per cent of the catalogs could be filed in a standard letter-size vertical filing cabinet, and ten per cent in a standard bill-size file. Folders and expansion pockets are used for both standard letter-size and standard bill-size catalogs. The folders take care of small quantities of catalogs or circulars and the expansion pockets accommodate the larger quantities. They are filed numerically, according to manufacturer. Number 0 to 99 embraces all of the A's, 100 to 199 all of the B's, etc. The capacity of the numbering system is increased by the additions of .1, .2, .3, etc., after key numbers.

Many catalogs contain items that are in no way related to each other from the standpoint of proper classification according to commodity. When an effort is made to file this information according to commodity, numerous cross references have to be employed, which makes the system very complicated as compared with the simple method of filing catalogs strictly by number. A system was set up so that specific information could be obtained, if, as, and when needed.

The catalogs are under control of an illustrative, or visible revolving index file. It is made in duplicate, with one index arranged alphabetically and the other numerically with key numbers, 0 to 99 first, and additions 0.1 to 99.1 etc., following the key numbers. The alphabetical system is used for location of catalogs by names of manufacturers; the numerical, for location, or check, as well as control of numbers assigned to catalogs. Items can be located by means of a third index showing trade name and number.

Illustrative Commodity Card File

Over 170,000 illustrations of equipment have been mounted on $5'' \times 8''$ cards which list the identifying commodity number, trade name, trade number, and catalog number. The information contained in the Standardized Shop Commodity Index Book is duplicated on $5'' \times 8''$ guide cards, and all commodity cards with illustrations are filed in back of the guide cards. This arrangement serves as a check on the classifications in the commodity index, as well as a means for quick location of the desired items. Under this system, competitive devices are in one spot. By the use of catalog numbers on commodity cards, additional information can be obtained direct from the catalogs without the use of an index, in much the same order as is found in a clipping bureau. Commodity cards become active when related equipment is specified by any school shop. Such cards are fitted with a copy of specifications.

Specifications

In sending out our specifications two die-impressed stencil sheets, known as S-1 and S-2, are used. Stencil S-1 is the face sheet of the specifications. S-2 furnishes the rest of the sheets needed to complete the necessary information. These sheets, as may be noted in the accompanying illustrations, contain a description of the article, its commodity number as listed

SPECIFICATIONS (S.1)

FOR:- LATHE, METAL WORKING, SCREW CUTTING, FLOOR MODEL, GEARED HEAD, QUICK CHANGE GEARS, 12" x 6' BED

COM. NO.	8461-B1
CLASS	2246
PAGE	1 OF 2
DATE	1-8-43

1. INFORMATION REQUIRED:- Trade Names, Nos., etc., must be inserted in spaces provided to identify article covered by bid

MFR. .... ADDRESS ....
CITY .... STATE .... TRADE NAME .... MODEL NO. ....

2. DEVICES DIFFERING FROM SPECIFICATIONS:- (a) Will be considered, provided that all major differences are clearly indicated in writing, or by illustrations, attached to bid. (b) All "Standard" and "Extra Equipment" items, if mentioned below, shall be included provided no exceptions have been taken by bidder.

3. DELIVERY:- (a) To be made within .... days after receipt of contract. (b) Installation to include the placing and fixing of articles in operating position. (c) Delivery and installation to be made at the school and in the room mentioned on "Quotation Sheet" with all charges included as part of the "Total Price". (d) Electrical, gas, water and/or steam connections (if any) are to be made by others.

4. GENERAL:- (a) This specification is intended to cover new equipment and the latest model: GEARED HEAD LATHE
(b) To be used for instruction purposes. (c) To be furnished complete with appurtenances thereto and shall be constructed with the following salient features. (d) Materials and workmanship to be of high quality free from defects.

5. RANGE:- a) Swing over ways, 14½"
b) Swing over cross slide, 8"
c) Distance between centers, 30"
d) Length of bed, 6'
e) Capacity of spring collets, 1/8"--1"
f) Hole through spindle, 1⅜"
g) Compound rest travel, 3-1/4"
h) Spindle speeds:- High range, 19-1000 - 16 speed changes
i) Number of thread and feed ranges, 54
j) Range of thread cutting, 1½"--80 P.I.
k) Range of feeds, .0031" to .1666"
l) Overall:- Front to rear, 38" - Left to right, 90"
m) Net weight without motor, chucks or taper attachment, 2,650 lbs. (approx.)

6. BED:- a) To be fitted with one V-way and one flat way for tailstock
b) To be fitted with two V-ways for carriage
c) To be cast of iron, steel scrap (rail), nickel, chromium, and manganese compounded to make fine grained casting with high non-abrasive quality
d) To be fitted with legs suitable for floor mounting

7. HEADSTOCK:- a) Geared head precision type
b) Housing to be designed so as to completely enclose all gears and shafts except spindle nose
c) Spindle bearings and all main bearings to be double opposed taper roller bearings - preloaded
d) Spindle to be fitted with one gear - driven thru torque

(S.2)

LATHE, METAL WORKING-- Continued

COM. NO.	8461-B1
CLASS	2246
PAGE	2 OF 2
DATE	1-8-43

tube
e) All power shafts to be multiple splined
f) To be fitted with at least two hand levers to control the primary speed changes
g) To be fitted with at least one lever connected to operate a positive tooth clutch for sliding on and driving spindle through either high or low speed transmission gears
h) All shafts to be made of alloy steel - hardened and ground
i) All gears to be forged from high grade alloy steel
j) All sliding gears to be oil tempered and finished for correctness of tooth profile after tempering
k) End of spindle to be graduated for indexing spindle to cut multiple threads - slip gears etc to be designed for this purpose
l) To be fitted with cam lock type of nose
m) Spindle mechanism to be driven by multiple V-belt drive fitted with multiple disc clutch and brake

8. CARRIAGE:- a) To be fitted with ample bearing surfaces to support tool stresses developed under maximum working conditions
b) Both front and rear ways of carriage as well as cross slide to be automatically lubricated from apron oiling system

9. APRON:- a) Fitted with quick in and out positive feed clutches - lever operated
b) Longitudinal feed and thread cutting mechanism to have safety lock
c) To be fitted with large graduated dial for cross feed
d) To be driven for thread cutting purposes by means of commercial precision lead screw held to a maximum of error of .001" plus or minus per foot of lead

10. TAILSTOCK:- a) Barrel to be fitted with two-piece binder for spindle - to be designed to draw to the center with upward pressure on spindle so as to keep spindle in alignment with head spindle

11. GEAR BOX:- a) Quick change type
b) Fitted with anti-friction bearings for spindle
c) Automatic lubrication

12. STANDARD EQUIPMENT:- a) Large face plate
b) Small face plate
c) Micrometer carriage stop
d) Draw-in collet attachment with set of collets from 1/8" to 1" by 16ths
e) Taper attachment
f) 8" 3-jaw universal chuck - fitted to lathe with plate
g) 10" 4-jaw independent chuck - fitted to lathe with plate
h) Steady rest
i) Follower rest
j) Motor and switch as per following specifications

Group Classification No. 36 - 2-3H.P.1200- 3P

New system for analyzing specifications, special die-impressed stencils, shown here, S-1 and S-2

They show the salient features of each machine. Each feature starts a new line

SPECIFICATION ANALYSIS

S3

SCHOOL Washburne Trade NO. 81
SHOP Machine ROOM NO. 134

COMMODITY NO. 8461-B1
CLASS NO. 2246
BID NO. 43-1204
MOTOR CLASS NO. 906

TRADE NAME	MODEL	EACH	TOTAL	REMARKS	
					9
					8
					7
					6
					5
John Doe	Super	1250.00	25000.00	Geared Head	4
John Doe	856	1225.00	24500.00	Geared Head	3
John Doe	82-B	1200.00	24000.00	Geared Head	2
John Doe	567	500.00	10000.00	Cone Head	1

DATE Jan. 15,43 QUANTITY 20 BY John Doe 123456789

in the Standardized Shop Commodity Index, its class number, the number of pages contained in the specifications, its date of issuance, and a breakdown of the essential characteristics of the piece of equipment desired. The class number of the article is under the control of a card index, and is filed by its commodity number and so arranged that duplicate specifications will not be made of the same item.

Machinery specifications do not specify motors but are coded to indicate the horsepower and r.p.m. Standard motor specifications for single-phase, three-phase, 110-volt, 220-volt, A.C., and D.C. are prepared in one lot on form S-2 and attached to the machinery specifications. This eliminates a duplication of machinery specifications to obtain a desired motor and make it possible to include a suitable switch as part of the motor specification.

Army, Navy, federal, state, and municipal specifications offer no quick way of comparative analysis of competitive bids. A new system of analyzing specifications is being tried out very successfully by the Chicago Board of Education. It consists of the special die-impressed stencils S-1 and S-2, which contain a number of headings such as "Range," "Headstock," "Bed," etc., with the salient features of each machine broken up and placed under the proper heading and with each feature starting a new line.

Attention is called to the set of numerals, 1-2-3-4-5-6-7-8-9, at the right side of the specification sheet. When bids have been received a face or an analysis sheet, S-3, is attached to a copy of the specifications. This sheet contains the trade name of the article, the manufacturers' number, the price, the bid number, the school and shop for which the article is intended, and the quantity to be purchased on the bid. It also contains the commodity class and motor class number of the article according to our Standardized Shop Commodity Index, and the numerals 1 to 9 arranged to match up with the numbers on the face sheet of the bid. The bidders are arranged in order of price, No. 1 representing the low bid. The numerals on the face sheet of the bid are then spotted by colored pencil to indicate how closely each bidder approaches specifications. Blue indicates that they comply, red that they do not, and green that they substantially comply. When the bid, with this sheet attached, is placed before the Director of Educational Expenditures and Economy, it is possible to make the selection of the article with speed and precision. A copy of the analysis is retained in the files for future reference. On the basis of the selection made, in the manner described, the purchasing agent is then instructed to obtain the equipment selected.

We have found that through the use of the Standardized Shop Commodity Index and the Inventory of School Equipment, it is possible to control the inventory, selection and purchase of equipment. The catalog file saves endless delay in obtaining information for specifications and for analysis of bids, and the illustrative commodity file increases the range of selection of equipment by having competitive devices filed in the same location. By means of the special specification sheets, with the system of analysis, a new shop may be quickly set up. This method increases the accuracy in the selection of shop equipment. The stencil sheets are not discarded but are carefully cleaned and used many times, in order to save the cost of retyping specifications.

Author's note:—Credit is to be extended to the WPA for its services in taking inventory and compiling the data which has made our set-up possible. This work was supervised by Mr. Lloyd M. Williams, an employee of the Bureau of Educational Expenditures and Economy of the Chicago Board of Education. Many of the clerical engineering devices that have helped speed up our services were designed by Mr. Williams.

THE BLACK & DECKER MFG. CO.

Towson, Maryland

BRANCHES IN

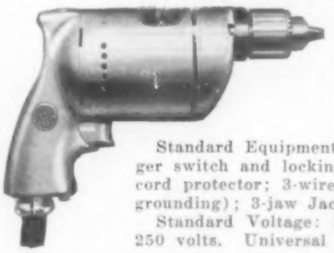
Atlanta, Baltimore, Boston, Buffalo, Chicago, Cleveland, Dallas, Denver, Detroit, Indianapolis, Kansas City, Los Angeles

Black & Decker
ELECTRIC TOOL HEADQUARTERS

BRANCHES IN

Memphis, Minneapolis, New Orleans, Newark, New York, St. Louis, Oakland, Philadelphia, Pittsburgh, San Francisco, Seattle

HOLGUN ELECTRIC DRILL



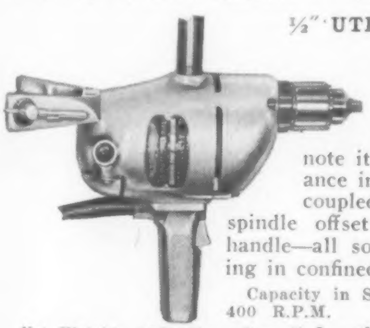
An all-purpose drill—perfectly balanced, perfectly proportioned, of surprising compactness and smooth, rugged power for heavy duty production work.

Standard Equipment: 2-pole automatic-release trigger switch and locking pin, mounted as a unit with cord protector; 3-wire cable and plug (3rd wire for grounding); 3-jaw Jacobs chuck and key.

Standard Voltage: 110; also available for 220 or 250 volts. Universal Motor.

¼" Std. Holgun	Standard Speed	Low Speed
Capacity in Steel	¼"	¼"
No-Load Speed	1700 R.P.M.	500 R.P.M.
Weight, Net	2¾ lbs.	3 lbs.
Overall Length	6¾"	7⅛"
Spindle Offset	⅜"	⅜"
Code No.	345	346
Price, complete, specify voltage	$32.50	$38.00
Heavy Duty Holgun—End Handle		
Capacity in Steel	¼"	¼"
No-Load Speed	1700 R.P.M.	500 R.P.M.
Weight, Net	3¾ lbs.	4 lbs.
Overall Length	7¾"	8⅜"
Spindle Offset	⅜"	⅜"
Code No.	457	460
Price, complete, specify voltage	$36.00	$41.50
Heavy Duty Holgun—Side Handle		
Capacity in Steel	¼"	¼"
No-Load Speed	1700 R.P.M.	500 R.P.M.
Weight, Net	4 lbs.	4¼ lbs.
Overall Length	7⅞"	8½"
Spindle Offset	⅜"	⅜"
Code No.	459	462
Price, complete, specify voltage	$36.00	$41.50

½" UTILITY DRILL



This new drill is a full 3½ inches shorter than the previous model, and 2½ pounds lighter in weight. You'll note its perfect operating balance instantly; also the close-coupled construction, minimum spindle offset and horizontal spade handle—all so important when drilling in confined space.

Capacity in Steel, ½"; No-Load Speed, 400 R.P.M.

Net Weight, 10¾ lbs.; Overall Length, 13¾".

Price, complete, specify voltage—(Code No. 361) $53.00

Available for 32, 110, 220 or 250 volts. Universal Motor.

7" SPECIAL SANDER

The popular general-purpose Sander for varied shop use.

No-Load Speed, 4200 R.P.M.; Net Weight, 12¾ lbs.

Overall Length, 17½"; Pad Diameter, 7".

Price, complete, specify voltage—(Code No. 92) $53.00

ELECTRIC BENCH GRINDERS

6" JUNIOR BENCH GRINDER

A full quality Black & Decker unit with ball bearings throughout, wheel guards, tool rests and convenient handle — unusually low in price.

Wheel Size ......6" x ⅝" x ½"

Motor Rating ....¼ H.P.

Not universal

Price for all 1-phase A.C. voltages and cycles $22.50

6" HEAVY DUTY BALL BEARING BENCH GRINDER

For heavy duty service and longer life this unit is equipped with ball bearings, also enclosed wheel guards, tool rests and handle.

Wheel size ....6" x ¾" x ½"

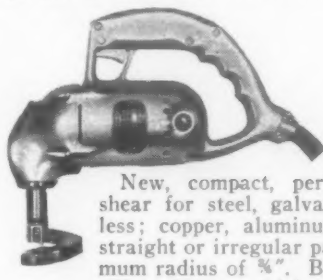
Motor rating ....⅓ H.P.

Not universal

Price for 110 volts, 50-60 cycles, Single phase A.C. voltages only $38.00

All D.C. voltages only 42.00

PORTABLE LECTRO-SHEAR



New, compact, perfectly balanced sheet metal shear for steel, galvanized iron, monel and stainless; copper, aluminum and lead. Easily follows straight or irregular pattern line and cuts to a minimum radius of ⅝". Blades are easy to sharpen and adjust for any thickness up to capacity.

Specifications	No. 18 Gauge Lectro-Shear	No. 16 Gauge Lectro-Shear
Capacity: in Steel (U. S. Std.)	18-gauge	16-gauge
Cutting Speed: No-Load	2500	2500
(Strokes per minute): Full-Load	1500	1500
Weight: Net	5½ lbs.	8½ lbs.
Overall Length	9⅛"	12⅛"
Code No. (specify voltage)	258	259
Price, complete	$60.00	$76.00

VACKAR ELECTRIC VACUUM CLEANER

The No. 95 Vackar is a super-powered cleaner for both automotive and industrial use. With both inlet and outlet hose connections, it can be used as a vacuum cleaner or a blower. Motor and mechanism are completely protected from moisture and unharmed under such use. Ideal all-purpose cleaner for heavy-duty service in garages, shops, factories, etc.

Dimensions: Height ....28"
Top Diam. ....16¼"
Base Diam. ....18½"
Sealed Vacuum Pull ....65"
Weight: Net ....52 lbs.

Price, complete, specify voltage (Code No. 425) $137.50

Standard voltage 110; also available for 220 or 250 volts.

Complete line includes: Drills, Drill Stands, Hole Saws, Screwdrivers, Nut Runners, Tappers, Hammers, Saws, Glue Pot, Bench Grinders, Die Grinders, Portable Grinders, Shears, Sanders, Buffers, Vacuum Cleaners, Valve Shop, Valve Refacers, Valve Seat Grinders, Valve Lapper and Supplies. **COMPLETE CATALOG SENT ON REQUEST.**

THE LUFKIN RULE COMPANY

Saginaw, Michigan, U. S. A.

NEW YORK: 106–110 Lafayette Street

LUFKIN

PRECISION TOOLS:

- Micrometers
- Squares, Combination, etc.
- Calipers
- Dividers
- Steel Scales
- Indicators
- Protractors
- Bevels
- V Blocks
- Clamps
- Hold Downs
- Scribers
- Rules, Steel
- Punches, Center & Drive Pin
- Gages:
  - Center
  - Depth
  - Drill Grinding
  - Feeler
  - Planer
  - Radius
  - Screw Pitch
  - Shaper
  - Surface
  - Telescoping
  - Thickness
- Tool Sets, Students

•

MEASURING TAPES:

- Chrome Clad Steel
- Nubian Finish Steel
- Stainless Steel
- Engineers Steel
- Surveyors Chain
- Metallic and Other Woven Tapes
- Pocket, Steel & Woven

•

STEEL TAPE-RULES:

Flexible—Rigid

•

RULES:

- "Red End" and Other Spring Joint
- Aluminum Folding
- Boxwood & Caliper
- Steel and Brass
- Manual Training
  Etc., Etc.

Inside Micrometer Set

Micrometer Depth Gage

Test Indicator

Radius Gage Set

Tape-Rule For Inside and Outside Measuring

Send for CATALOG OF PRECISION TOOLS

MILLERS FALLS COMPANY

Greenfield MILLERS FALLS TOOLS SINCE 1868 Massachusetts

28 Warren St., New York City — 100 So. Jefferson St., Chicago, Ill.

Note: In view of the increasing shortage of tools as America's war effort progresses, it is to the advantage of every school shop to select quality equipment that will stand up in long, strenuous service. Choose Millers Falls tools, standard items in vocational training as well as in industry. Available through school shop suppliers everywhere. Write for catalogs.

HAND AND BREAST DRILLS

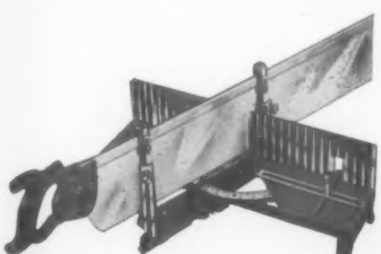
Straight and ratchet, enclosed gear, single and two-speed — 27 models. Bench drills and boring machines.

PLANES

An unbeatable line, developed through 74 years of quality toolbuilding. Many kinds and sizes —smooth, jack, fore, jointer, block, rabbet, router, rabbet and fillister, scrub, and scraper.

MITRE BOXES

Complete line of mitre boxes, metal-cutting boxes, portables, open fronts. Best known are the famous Goodell All-Steel and Langdon Acme—high quality, great value.

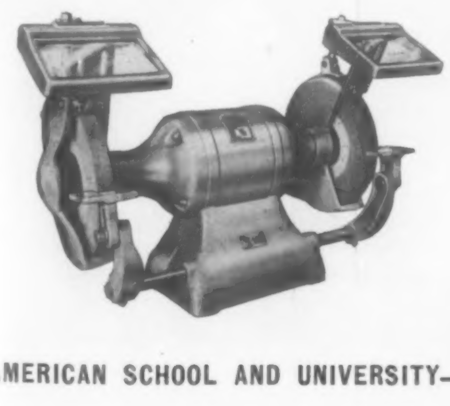


LEVELS

For every purpose and condition of service; 18 wood models, 5 iron, others.

BENCH GRINDERS

Complete line—$\frac{1}{3}$ h.p. to full 1 h.p. All voltages, cycles, single or three-phase. Eye-shields, lights, pedestals.



ELECTRIC DRILLS

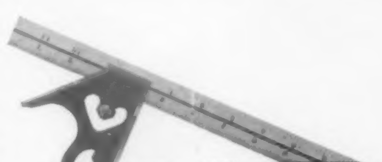
Complete line—$\frac{3}{16}''$ to $1''$. Other portable electric tools in every speed and capacity: screw drivers and nut runners; grinders; hammers; saws; disc sanders; polisher. Stands, adapters, accessories.

HACK SAWS

Finest frames ever made, many sizes and styles. Blades for all uses: Tuf-Flex, general-purpose hand blade, super-tough, super-flexible, cuts thin-walled tubes or tough tool-steel rods without stripping or breaking. Blu-Mol Double-Life, sensational new blade with cutting edges on each side, now in widespread industrial use, should be demonstrated in every school shop.

PRECISION TOOLS

Combination squares: precision ground, etched graduations and figures, with and without level and scriber. Also: rules; micrometers; thickness gauges; calipers and dividers; screw pitch, depth, center and surface gauges; squares; sets; and bevel protractors.



BRACES AND AUGER BITS

Finest line of braces made: standard, ratchet, corner, whimble, angular; auger handles. All kinds and sizes of auger bits: solid center, single twist, expansive, electrician's, ship; car bits, gimlets, countersinks, etc.

STANLEY TOOLS

EDUCATIONAL DEPARTMENT

New Britain, Conn.

STANLEY ELECTRIC TOOL DIVISION

THE STANLEY WORKS

New Britain, Connecticut

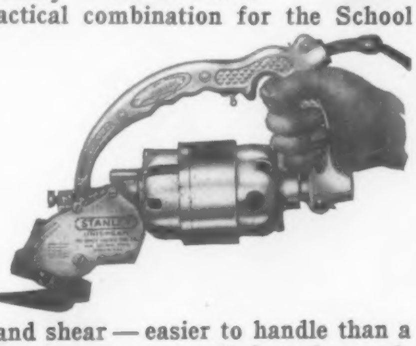
STANLEY
PORTABLE DRILL
No. 121—½" Capacity

A most practical size electric drill for the School Shop. Round shank twist drills and bits, hole saws, countersinks, plug cutters, etc., can be held in this three-jaw geared chuck. Complete line of electric drills, sizes ¼" up to ⅞".

DRILL STANDS

There is a Stanley Drill Stand available for any Stanley Electric Drill. They make a practical combination for the School Shop.

"MIGHTY MIDGET" UNISHEAR

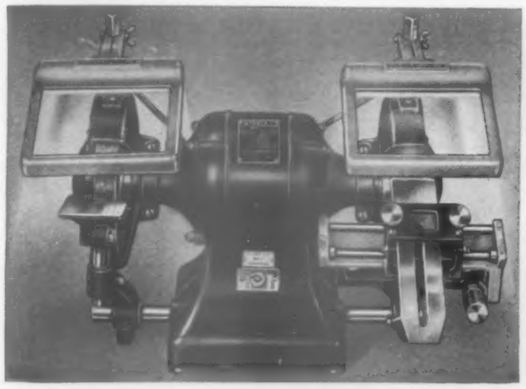


Motor driven hand shear — easier to handle than a pair of snips. Cuts 18 gauge hot rolled steel or galvanized iron as fast as you can feed it. Cuts large sheets or small pieces easily. 100% safe.

HAND ROUTER
No. 10
18,000 R. P. M.

Adds the professional touch to projects. High speed produces smooth work—sanding practically unnecessary. It will perform countless woodworking operations — shaping, inlay work, routing, templet work, veining, relief work, grooving, rabbeting, corner beading. Bench Stands and Attachments available for converting to a spindle shaper.

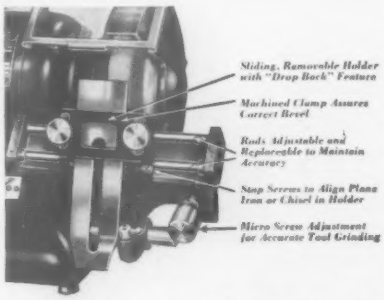
Write for Stanley Router-Shaper Catalog.



EDGE TOOL GRINDER No. 677

Ideal for the School Shop. Ball bearing, 7" x 1" wheels — one wheel specially designed for edge tool grinding, one wheel for general purpose grinding. Motor operates at slow speed. Equipment includes Plane Iron and Chisel Grinding Fixture, "Flud-Lite" Safety Eye Shields.

PLANE IRON AND CHISEL GRINDING FIXTURE No. 568



Designed to keep edge tools in perfect condition easily and accurately. Furnished with Nos. 677 and 667 Stanley Grinders

"FLUD-LITE" SAFETY EYE SHIELDS No. 600

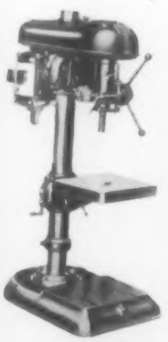
Fit Bench and Belt-Driven Grinders

Offers greater visibility and maximum protection for grinder operator. Adjustable up or down, and tilt to suit operator's position. Cannot be moved to non-guarding position without dismantling. Throws light directly on grinding wheel and work. Two light bulbs can be connected so that lights go on or off as grinder switch is operated.

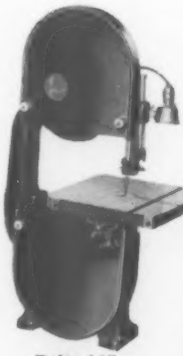
Send for Electric Tool Catalog with complete information on Drills, Grinders, Electric Hammers, etc.

DELTA MANUFACTURING COMPANY

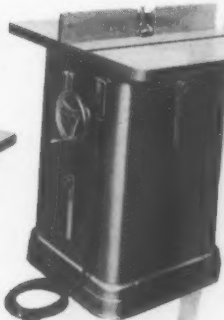
670-A E. Vienna Avenue
Milwaukee, Wis.



Delta 17" Drill Press



Delta 14" Metal Cutting Band Saw



Delta Shaper

Low-Cost DELTA MACHINES for the School Shop of Tomorrow

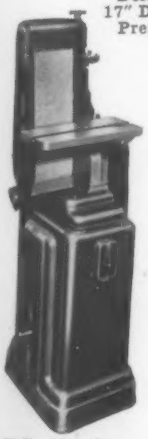
As far-sighted educators have long recognized, the important changes that have taken place in the types of machines used in America's industrial shops have a direct bearing on the question of school shop equipment.

The trend toward the increased use of low-cost, high quality compact machines in all branches of U. S. industry has assumed the proportions of an industrial revolution.

In addition to the wide-spread employment of Delta low-cost machines for normal production —war production industries have installed these machines by the tens of thousands.

When the inevitable reversion to "reconstruction production" arrives—the many advantages of these machines—their low cost, flexibility, portability, low maintenance costs—will assure them a permanent place in our industrial economy.

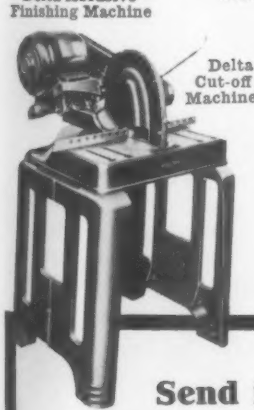
Keep in touch with the latest developments in this new type machine tool field. Send for New Delta Catalog.



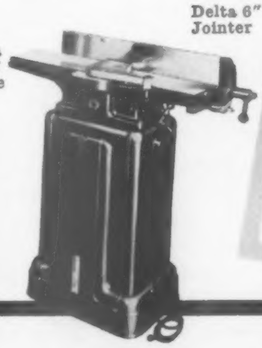
Delta Abrasive Finishing Machine

Delta Carbide Tool Grinder

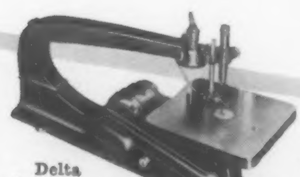
Delta Grinder



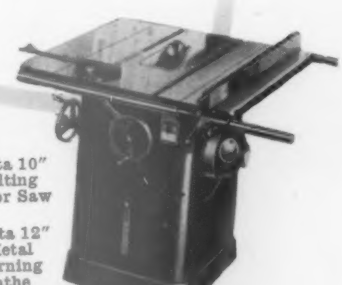
Delta Cut-off Machine



Delta 6" Jointer



Delta Scroll Saw

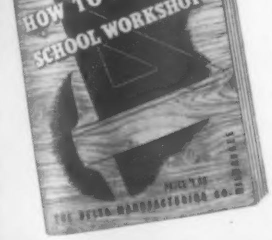


Delta 10" Tilting Arbor Saw

Delta Toolmaker Grinder

Delta 12" Metal Turning Lathe

Send for FREE School Shop Layout Book



This FREE new shop layout book contains numerous photographs and floor plans of actual school shops that have been submitted by vocational instructors from all over the country. Shows ingenious solutions of the problems of lighting, space, safety and efficiency.

THE R. K. LeBLOND MACHINE TOOL CO.

Cincinnati, Ohio

Largest Manufacturer of a Complete Line of Lathes

The LeBlond Regal Lathe is ideal for training work because it has many of the features and characteristics of our far more expensive heavy duty lathes. When used for the lighter turning for which it is built, the Regal can be depended upon for the same long years of service as its heavier companions. Available with standard floor legs or bench legs.

FEATURES

New Rapid Speed Selector (See illustration above).

Selective Geared Headstock—8 speeds—steel gears throughout—reverse to leadscrew, feed rod **and compounding gears entirely within headstock.**

One-piece Apron—box type—rack pinion and hand-wheel on ball bearings—moving parts submerged in oil.

Geared Feed Mechanism—fool-proof—with both leadscrew and feed rod—automatic resetting safety device prevents undue strain on rod and feed mechanism—tumbler gears and swinging plates eliminated.

Bed—inverted V type—exceptionally heavy—cross girths at close intervals to resist twist and torsional strains.

GAP BED TYPE

In many instances it is necessary to use a large lathe to swing a piece of work—while the actual machining operation can be handled by a lathe of smaller swing. For this purpose the LeBlond Regal Lathe (except the 13- and 15-inch sizes) can be furnished with a gap bed. All the improvements and labor-saving devices are, of course, retained.

STANDARD EQUIPMENT

Reversing type motor, vee belt motor drive complete, motor control switch. Also large and small face plates, steady rest, graduated compound rest, tool post, collar and wedge for same, taper spindle sleeve, adjustable thread cutting stop, centers and necessary wrenches, foundation plan, instruction book, lag screws and washers.

SPECIFICATIONS (Regal Lathe)

Size	13-in.	15-in.	17-in.	19-in.
Swing, in.:				
Over Way	13¼	15¼	17¼	19¼
Over Carriage and Taper Attach	8¼	10	10½	12
Centers,* min. in.	18	18	30	30
Spindle Speeds:				
Number	8	8	8	8
Range, r.p.m.	25-500	25-500	20-425	20-425
Feeds:				
Number	48	48	56	56
Range, in.	.0025 to .144		.001 to .125	
Threads, per in.	4 to 224		1½ to 184	
Net Weight with Motor, lbs.**	1045	1240	1985	2225

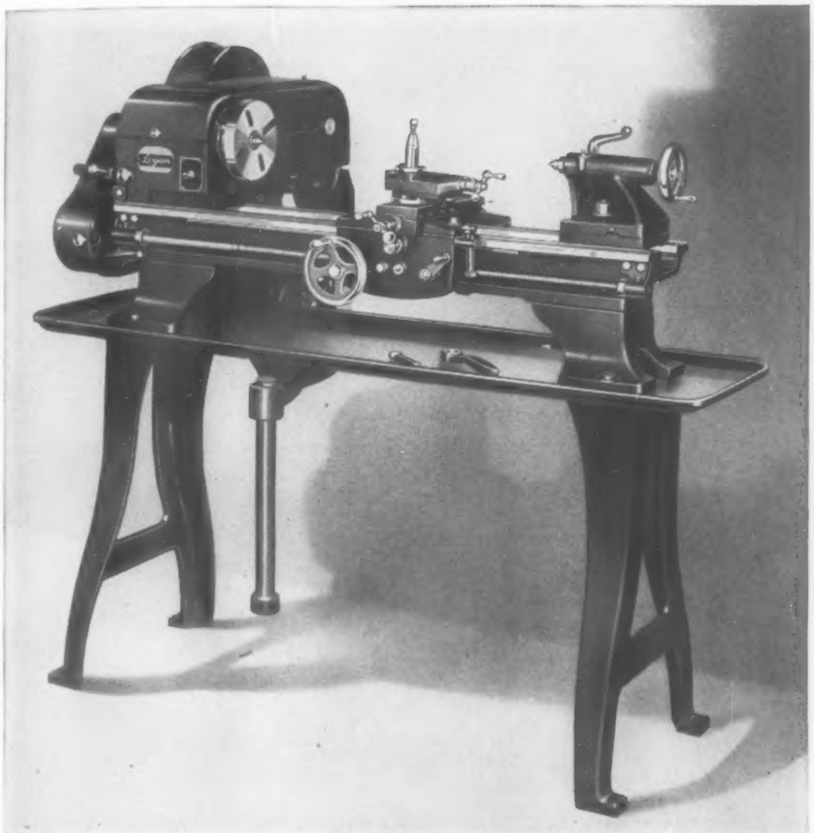
* Increasing in increments of 6 inches on 13- and 15-inch and 12 inches on 17- and 19-inch sizes.

** Approximate, with minimum center-to-center dimension.

LOGAN ENGINEERING COMPANY

4901 Lawrence Avenue, Chicago, Ill.

Logan A NAME TO REMEMBER WHEN YOU THINK OF LATHES



Logan No. 200 Back Geared Screw Cutting Lathe
10" Swing; 24" Between Centers

BRIEF SPECIFICATIONS

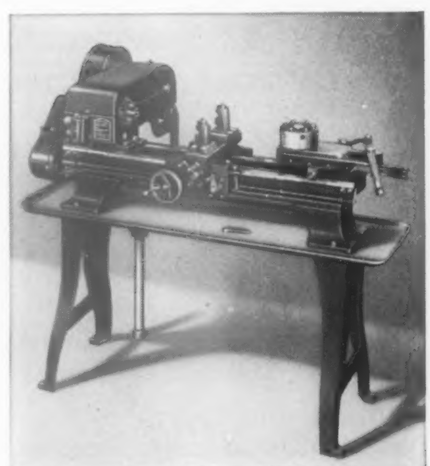
- Swing over bed .... $10\frac{1}{2}$"
- Distance between centers .... 24"
- Thread cutting, per inch ...... 4 to 216
- 12 Spindle speeds.... 30 to 1450 R.P.M.
- Bed Dimensions .... $6\frac{15}{16}$" x $43\frac{1}{8}$"
- Precision, pre-loaded ball-bearing headstock spindle
- Spindle Hole .... $\frac{25}{32}$"
- Precision ground ways: two prismatic V Ways; two flat ways

No. 830 Hand Screw Machine

The Logan Line was developed to supply a specific need for a series of fine, rugged production lathes, engineered for sustained accuracy. Advanced design, sound engineering, expert workmanship and rigid inspection, all contribute to their excellence. A comparison of their specifications will reveal many superior features heretofore incorporated only in larger, heavier and more costly equipment. These features include: pre-loaded, precision, grease-sealed ball bearing headstock (bearings require no lubrication or adjustment for their entire life); patented countershaft assembly with three point suspension and rubber mountings to absorb vibration; precision ground ways, two prismatic V ways and two flat ways. The headstock and countershaft are of streamlined design. All pulleys and belts are completely guarded for safety of operation, yet always readily accessible by simply lifting guard.

In addition to the model illustrated, the Logan Back Geared Screw Cutting Lathe is available in a Bench Model (No. 210), and a Quick Change Gear Model (No. 820).

Catalog sheets for all models giving complete description and specifications will be furnished on request.



No. 850 Manufacturing Turret Lathe

OLIVER MACHINERY COMPANY

Grand Rapids, Mich.

BRANCH OFFICES

50 Church Street, New York City
1450 N. Monitor Avenue, Chicago

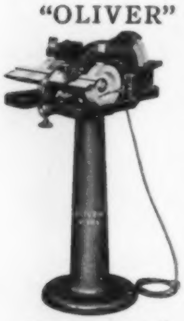
901 Commerce Building, St. Louis
221 Sexton Building, Minneapolis

METAL SPINNING DEVELOPING RAPIDLY

It is easy to learn and the art possibilities are unlimited. Ask Oliver about Metal Spinning.

Metal Spinning Lathes by Oliver have been developed to the point of Leadership in this line. Lathes are powerful. Boys love the work. Lathes can be used for wood turning also.

"OLIVER" OILSTONE TOOL GRINDERS



Junior with 6" Wheels

Every shop using edge tools should have an Oilstone Grinder.

No. 585, illustrated at right, carries two 8" Oilstone wheels, a dry grinding wheel and emery cone.

"OLIVER" CIRCULAR SAWING MACHINERY

Built in sizes from large, heavy saws to junior models. The "Oliver" No. 232D Tilting Arbor Saw Bench is illustrated. It carries 12 or 13" saws. Motor arbor. Table 33¾ x 34¾.

Other types of "Oliver" saws are Universal Saw Benches, Miter Saws, Variety Saws, Cut-off types, etc.

Important Note: It is impossible with so large a line as the "Oliver" to put specifications into such a small space. We will gladly send to inquirers specifications and literature fully describing any machines in our line.

HIGHER SHOP STANDARDS WITH "OLIVER"

Write for descriptive literature

The "Oliver" No. 144 Hand Planer and Jointer, illustrated, is built in 6" and 8" sizes.

It has won acceptance everywhere because of its modern and sturdy design and because of the fine workmanship and precision built into it.

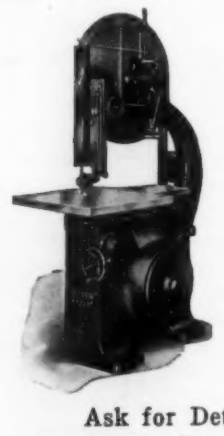
A large line of Jointers from a lighter 6" type up to the biggest and heaviest jointers for production or pattern work are to be found in the "Oliver" line.

Special attention in designing has always been given to safety features. Let our broad experience be used in helping to plan your woodworking shops.

"OLIVER" WOOD LATHES

are built in many types and sizes from largest pattern makers' lathes to junior sizes. No. 51, illustrated at right, is a 12" motor head speed lathe giving all speeds from 600 to 3600 r.p.m.

"OLIVER" BAND SAWS



Full line from largest high speed band saws to 18" Junior. We illustrate our popular 30-inch, No. 217.

No. 299 Surfacer is illustrated at right.

Ask for Details and Prices on "Oliver"

- Circular Saw Benches
- Band Saws
- Band Saw Brazers
- Jig Saws
- Carving Machines
- Surface Planers
- Jointers
- Wood Lathes
- Metal Spinning Lathes
- Sanders (Specify Type)
- Boring Machines
- Mortisers
- Tenoners
- Shapers
- Wood Trimmers
- Oilstone Tool Grinders
- Electric Glue Pots
- Woodworkers Vises

RIVETT LATHE & GRINDER, INC.

RIVETT Brighton, Boston, Mass., U. S. A. RIVETT

RIVETT 918 Precision Bench Lathe

RIVETT 608 Screw Cutting Lathe

RIVETT 918 Hand Screw Machine

RIVETT 715 Precision Bench Lathe

RIVETT PRECISION BENCH LATHES

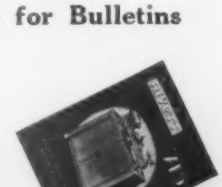
There is no finer machine than a Rivett bench lathe for teaching true precision and basic fundamentals required for a sound foundation in any skilled machinist trade. For more than fifty years Rivett precision bench lathes have been favorably known the world over. Their presence in a laboratory or instruction room adds a mark of quality and denotes the highest standards.

RIVETT 608 SCREW CUTTING LATHE is recognized by technical instructors of machine shop practice as the finest demonstrator for teaching construction, working principles and functions of lathes. Basically "608" is a small but exceedingly powerful engine lathe with available attachments to accomplish practically every machining operation within guaranteed precision limits. "608" has 8½" swing, 1" collet capacity and 40" bed.

RIVETT 918 BENCH LATHE AND HAND SCREW MACHINE combines the features of rugged construction, long lasting precision and operating convenience. Ball bearing spindle and dynamic balance permit vibrationless spindle speeds within the range of drive selected. As a bench lathe "918" is fitted with compound slide rest and tailstock, as a hand screw machine it is fitted with turret and cross slide. "918" has 9" swing, 1" collet capacity and 39½" bed.

RIVETT 715 BENCH LATHE is a small lathe incorporating the latest in modern design to attain high spindle speeds, long precision life and vibrationless performance. No better machine could be chosen for teaching tool and die work. The grinding and milling attachments extend the machining operations that can be performed. "715" has 7" swing, ¾" collet capacity and 33" bed.

For Further Description Write for Bulletins



SOUTH BEND LATHE WORKS

South Bend, Indiana, U. S. A.

Lathe Builders for 36 Years

South Bend 9" Precision Lathe

South Bend 10"—1" Collet Bench Lathe

South Bend 13" Precision Lathe

South Bend 14½" Precision Lathe

South Bend Series 1000 Turret Lathe

SIZES AND TYPES OF SOUTH BEND LATHES

South Bend Engine Lathes, Toolroom Lathes, and Turret Lathes are manufactured in a variety of sizes that make it possible to select the type and size that is best suited to your shop requirements. The Engine Lathes are manufactured in five sizes: 9", 10", 13", 14½", and 16" swings, with bed lengths from 3' to 12'. The Toolroom Lathes are available in four sizes, from 10" to 16" swings. The Turret Lathes are made in two sizes: 9" and 10" swings. Numerous practical attachments are available.

South Bend Precision Lathes have been selected by thousands of progressive educators in the past 36 years as the most practical and efficient lathes for metal working instructional purposes. Paralleling the trend in industry, this preference has made possible the instruction of students on the same lathes that they will use in the machine shops and toolrooms of industry. Their accuracy, ruggedness, safety features, ease of operation and versatility are a few of the reasons why they are unsurpassed for school shop use. Write for catalog and name of nearest dealer.

BOOKS FOR SCHOOL SHOP WORK

"South Bend Machine Shop Course" book (50c) contains twelve practical lathe projects with detail drawings and full description of all machining operations and their sequence. Sample copy sent free on request to shop instructors or supervisors.

"How to Run a Lathe" (25c) consists of 128 pages of information on the operation and care of lathes. Used extensively as a text book on lathe work —more than 1,900,000 copies have been published. Sample copy sent free of charge upon request to shop instructors or supervisors.

MOTION PICTURES ON LATHE OPERATION

Based on the Book, "How to Run a Lathe"

Two new 16 mm sound films in color titled "The Lathe" and "Plain Turning" are available on a free loan basis to all recognized institutions teaching machine shop work. These films convey the primary information required by students for operating a lathe and demonstrate the basic operations involved in machining a cylindrical shaft held between lathe centers. Each film is 800 feet long and requires a showing time of 20 minutes.

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Baltimore, Md.—Carey Machinery & Supply Co.
Bridgeport, Conn.—A. C. Bisgood
Buffalo, N. Y.—R. C. Neal Company, Inc.
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Rochester, N. Y.—Ogden R. Adams
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San Francisco, Cal.—Moore Machinery Company
Seattle, Wash.—Star Machinery Company
Syracuse, N. Y.—H. A. Smith Machinery
York, Pa.—York Machinery & Supply Company

SOUTH BEND *Precision* LATHES

WALKER-TURNER CO., INC.

2243 Berckman St. Plainfield, N. J.

Machine Tools for Metals, Plastics and *Other Materials*

Drill Presses · Radial Drills · Metal-Cutting Band Saws · Metal Cut-Off Machines Polishing Lathes · Motor Grinders · Flexible Shaft Machines

Walker-Turner Machine Tools are practical industrial production machines, ideally suited to school and vocational training because their efficient, simplified design makes them easy to operate, therefore more quickly mastered by beginners. Each machine is compactly constructed—amply safeguarded—accurate in operation.

Because of the huge demand for metal working tools in schools and war plants, the famous line of Walker-Turner Woodworking Machines has been discontinued for the duration. The following pages give details on Walker-Turner Machine Tools for Metals and Plastics. Our large facilities are concentrated on 24-hour production of these machines, bringing the prices within reach of school budgets and permitting prompt shipment for your war training program.

WALKER-TURNER DRILL PRESSES

These 15″ Drill Presses are available in several bench and floor models, all incorporating the efficiently designed Drill Head features shown at the right, which provide highly accurate spindle operation. Made of finest materials, built to precision standards, Walker-Turner Drill Presses are easily operated, stand up under continuous use.

SPECIFICATIONS: Standard spindle speeds, with 1740 r.p.m. motor, 600, 1250, 2440 and 5000 r.p.m. Calibrated depth stop, positive locking device, 4-spoke pilot wheel feed, columns precision ground. Spindle travel 3⅝″. Chuck to table, 12″; chuck to column 7½″; drills to center of 15″ circle. Bench model, 39½″ high, 10″ wide, 25″ deep. Floor models, 69″ high, 25″ deep. Foot feed available.

DRILL HEAD CONSTRUCTION

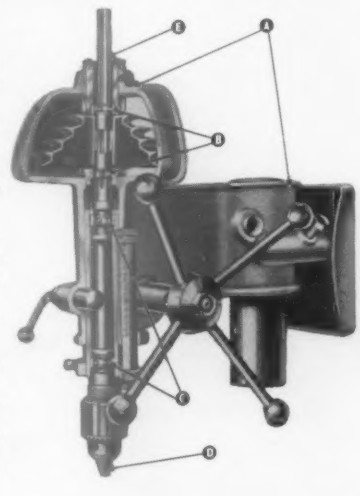
A. One-piece head casting, precision bored to assure correct bearing alignment.

B. Bearings above and below drive pulley take strain evenly, eliminating spindle "whip."

C. Precision deep-groove bearings, with thrust taken by upper bearing.

D. Jacobs chuck for maximum accuracy.

E. A few drops of oil placed in cap will lubricate entire spindle and all four bearings. Lowest bearing sealed against dirt, dust and particles.



MULTIPLE SPINDLE MODELS (Right)

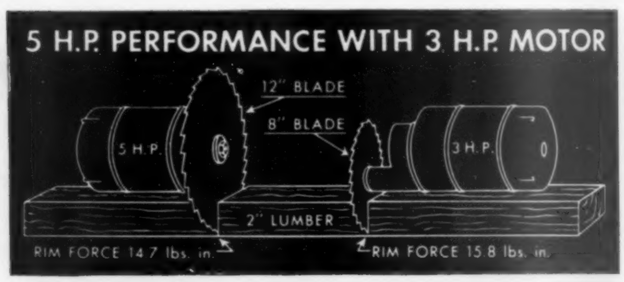
Walker-Turner Drill Presses are available in 2, 4 and 6 spindle models. Shown herewith is a battery of six 20″ Drill Presses in line for group operation.

METAL CUT-OFF MACHINE

This machine utilizes the "transverse travel" method, which permits cutting wide, flat materials, bulky pieces and many different shapes of ferrous and non-ferrous metals, ceramics and plastics. Gliding ram mounted on 8 precision ball bearings provides finger-touch control. Head operates in many positions, affording wide usefulness. Height, with steel stand, 61"; floor space 4 ft. x 5 ft.; ram travel 21½"; vertical adjustment, 8½"; working table, 17" x 45".

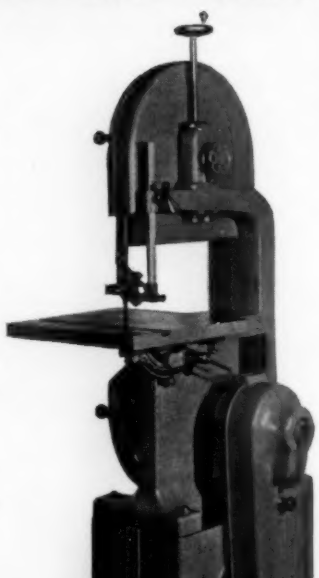
PATENTED, GEARED, SHOCKPROOF MOTOR

This motor gets the shaft closer to the work, thus smaller wheels, with greater rim force, may be used.



This also permits the use of smaller motors, giving 5 H. P. performance with a 3 H. P. motor. The motor has a "mechanical cushion" in the gears, to protect gear teeth against breakage under shock loads. Automatic resetting.

METAL-CUTTING BAND SAWS



These Band Saws have back-gearing and cone pulleys, similar to those on a screw-cutting lathe, providing wide speed range for cutting or trimming die steels, ferrous and non-ferrous metals, wood, plastics, almost any material. Widely used throughout the war industries. Blade tensioning devices minimize blade breakage. Guards completely protect operator. Heavy cast - iron, one - piece frame for extra strength and rigidity. Available in 14" and 16" models.

SPECIFICATIONS

Speed range from 50 to 2500 f.p.m. Dimensions: 16" MODEL, overall height, 71½", width, 30½", distance front to back, 22", table size, 17" x 18", blade to frame, 16", guide to table, 12". 14" MODEL, overall height, 65", width, 25¾", distance front to back, 20", table size, 16" x 16", blade to frame, 14", guide to table, 7". Tables tilt 45° one direction, 5° the other.

POLISHING LATHES

For high-speed polishing and grinding of small parts not exceeding 3" or 4". Motors are wound for 1½ H. P. in a 3 H. P. frame, ventilated with air inlet for cool, safe operation. Available with patented, shockproof, geared motor which provides two speeds with push button control. Abrasive dusts do not enter motor or bearings. Jacobs Chuck sizes ½" and ¾"; depths, 4½" and 4" universal. Speed ranges from 950 to 7200 r.p.m. Treadle foot brake for quick stops. Available in several models.

MOTOR GRINDERS

Model GR50, ½ H. P. Grinder

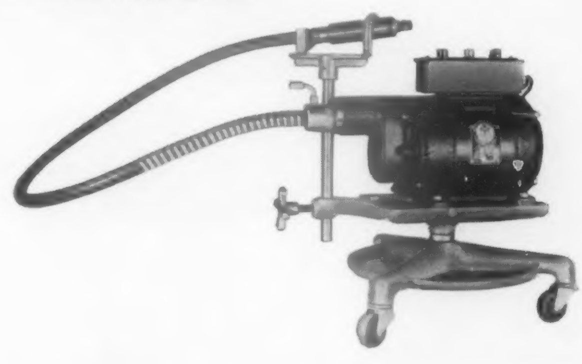
Motors in these grinders are totally enclosed with special shaft seals to prevent abrasive dusts from damaging vital parts. Precision, dust sealed ball bearings are used. Standard models operate at 2450 r.p.m. Model GR50 ½ H. P. Grinder, shown at the left, has table and stand of cast iron. Table is 18″ x 14″, with cooling cup at front center. Tool tray on either side of cup. Stand adjustable 12″ up or down. Wheels are 7″ in diameter, 1″ wide, ⅝″ hole. Guards designed to latest safety code requirements and have large, non-shatterable glass shields. Guards removable for buffing operations.

Model GR36, ⅓ H. P. Grinder

Uses wheels 6″ in diameter, ¾″ wide, with ½″ hole. Has tool rests adjustable two ways, guards with covers on outside of wheels, sturdy 10 amp. switch and 10″ cord and plug.

FLEXIBLE SHAFT MACHINES

Walker-Turner manufactures a complete line of Flexible Shaft Machines, Accessories and Flexible Shafting. These machines are used for grinding, snagging, drilling, sanding, polishing, and other applications. Available in bench models, table models and suspension models, with heavy duty, medium duty and light duty shafts. Made in single speed models and the 2-speed geared motor model (right), which eliminates belts and pulleys. Speeds of 4000 to 8000 r.p.m. with simple push button control.



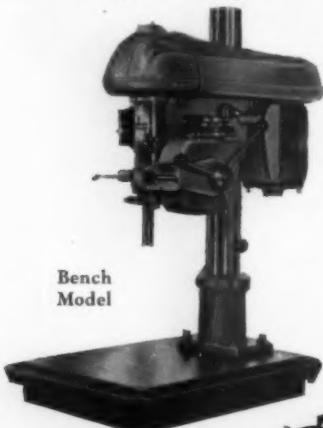
As one of the world's largest manufacturers of Flexible Shafting, Walker-Turner makes its own flexible shafting, including all parts. All shafting is extremely rugged, yet flexible. Cores wound for maximum strength, flexibility and long life.

Walker-Turner Machine Tools are stocked by distributors in all principal centers, who will be glad to give you full information on any machines or to demonstrate them in their showrooms. Write for name of nearest distributor. Complete catalog of Walker-Turner Machine Tools sent upon request.

20 inch POWER FEED DRILL PRESSES

These drill presses have a compact, smooth-acting power feed unit, driven from the drill press spindle. It operates with a clutch and engages at any point, regardless of spindle position. An automatic, positive release assures holes of uniform depth. Adjustments are quickly made. Operator simply pushes the convenient lever, and drilling or tapping operation completes itself automatically.

May also be operated by the hand feed, which provides sensitive control. Especially valuable for beginners, trainees and inexperienced help. Walker-Turner 20″ Power Feed Drill Presses are available in bench, floor and four spindle models.



Bench Model

SPECIFICATIONS

Drills to the center of a 20″ circle. Drills holes up to 1″ in cast iron. ¾″ in steel. Four feeding speeds: .003″, .006″, .009″ and .012″ per spindle revolution. Drilling speeds from 260 to 5200 r.p.m. Spindle travel, 6″. Distance spindle to column, 10″. Column, 3¾″ diameter. Ten spline spindle. SKF bearing equipped.

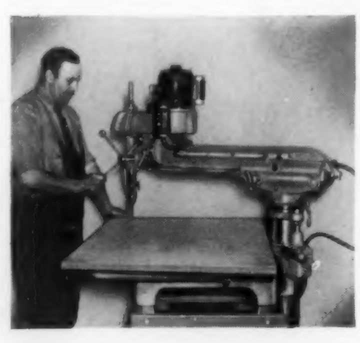
Floor Model

RADIAL DRILL

An extremely versatile, speedy, accurate Radial for drilling, tapping, routing and light profiling. Does much of the work of radials costing 5 to 6 times as much. Very easily operated, its accuracy is well within all industrial and commercial tolerances. Drill head, ram and cradle are raised and lowered by crank-operated screw mechanism at top of column. Overall height, with base, 68½″ maximum traverse of ram, 18″. Distance nose of chuck to table, 13½″. Standard spindle speeds 600, 1250, 2400 and 5000 r.p.m. with 1740 r.p.m., ½ H. P. single phase motor. Higher speeds with 2-phase motor. Jacobs Chuck, 0 to ½″ or No. 1 Morse Taper. Machined Table surface, 28″ x 19″.

Left: **Head tilts 45° right or left**

Right: **Showing wide range, which permits drilling to center of 62″ circle**



LYON METAL PRODUCTS, INCORPORATED

General Offices: 1111 Madison Ave., Aurora, Illinois

FACTORIES: Aurora and Chicago Heights, Illinois ASSEMBLY PLANT: Los Angeles, California

SALES OFFICES IN ALL PRINCIPAL CITIES — **Consult Your Classified Telephone Directory**

Engineered In Wood for the Duration

SHELVING

(Patent Applied for)

Lyon Wood Shelving is completely adjustable to individual needs and may be equipped with shelf dividers, bin fronts and shelf boxes.

CABINETS

In addition to the Storage type illustrated, Lyon Wood Cabinets are available in Wardrobe and Combination models. All models made in two sizes.

LOCKERS

Single tier lockers illustrated are available in four sizes. Double tier lockers are available in one size. Send for Lyon Catalog No. 1705.

WORK BENCHES

16 sizes and 144 assemblies. May be equipped with single drawer or two or three drawer units. Accessories include half and full depth shelves, back and end stops, shelf riser and foot rest.

WELDING BENCHES

Lyon Welding Benches may be equipped with fire brick top as illustrated or with steel working surface and protective shield for arc welding. Shelf for welding rods and blocks.

SHEET METAL BENCH

Lyon Sheet Metal Work Benches are equipped with heavy wood tops to withstand rough use and abuse. Three full depth shelves for storage of sheets.

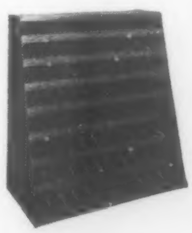
USE THIS BOOK IN YOUR POST WAR PLANNING

Any vocational school plans being made now can readily be built around the steel equipment shown in this 40-page, fully illustrated catalog. Get your copy now for complete information on the following Lyon made steel products—

Drawing Tables	**Blueprint Cabinets**
Work Tables	**Stools**
Wood Working Benches	**Shop Desks**
Tool Cabinets	**Shelving**
Storage and Wardrobe Cabinets	**Lockers**
	Folding Chairs
	Toolroom Equipment

TOOL STANDS

Two sizes and 24 models with or without casters, center shelf, single drawer or two or three drawer units.



TOOL STORAGE EQUIPMENT

A full line of specially designed cases for accessible and orderly storage and issue of tools. Adapted for use with commercial "check" system of control.

THE NEW BRITAIN MACHINE CO.

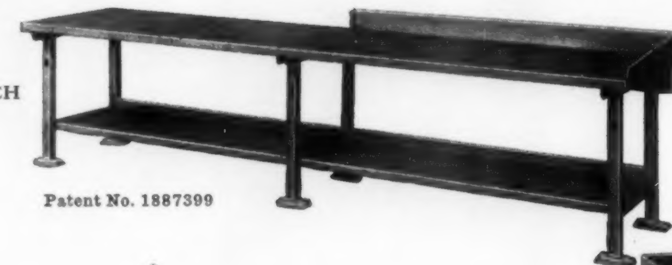
"New Britain" Shop Equipment — New Britain, Conn. — *"None Better" Tools*

When Victory is achieved, and we turn again to peace-time pursuits, new building programs will be under way. Many such projects are being planned now.

New Britain Steel Shop equipment will be available when the time comes. Let us help you to plan for the future now.

Send for Catalog No. 741

STEEL TOP WORK BENCH No. 1901



CONTINUOUS BENCHING

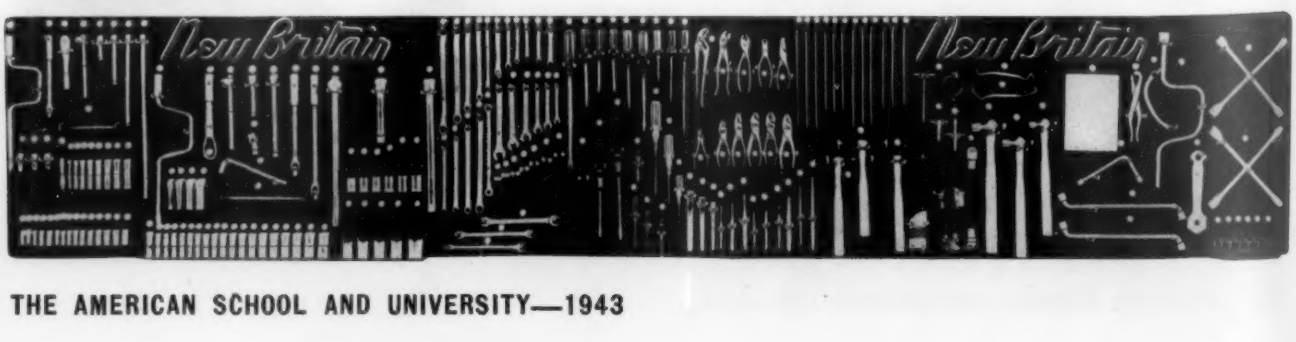
Patent No. 1887399

MAPLE TOP WORK BENCH No. 1910

In order to conserve steel for tanks, planes and warships, we have suspended production in the school shop equipment line for the duration. When Victory comes we will be ready to care for all requirements.

Send for this new complete Catalog No. 56M of "New Britain" Tools Containing these 15 Sections

Socket Wrenches	**Drills and Reamers**	**Ignition Tools**
Screw Drivers, Pliers	**Wire Wheels and Brushes**	**Pullers, Gear and Wheel**
Hacksaws	**Ford and Chevrolet Tools**	**Forged Wrenches**
Feeler Gauges	**Carburetor Tools**	**Body Repair Tools**
Files, Flat and Curved	**Piston and Valve Tools**	**Service Station Tools**



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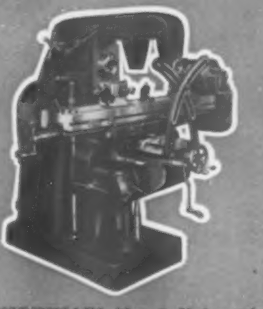

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No. 2. Milling with High Speed Steel. Publication No. M-1160.

No. 3. Milling Machine Practice, Publication No. M-737-1.

No. 4. Everyday Problems in Cutter Sharpening. Publication No. M-981.

The information in these booklets will prove helpful and show you how to get more from your present machines. They are free to teachers and school officials.

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